

D.2.1.8 Savannah, GA

The Port of Savannah is located on the South Bank of the Savannah River, about 35 km (22 mi) above the entrance from the Atlantic Ocean. Savannah is the third largest city in Georgia, and is the chief port of the State of Georgia. A Federal Project maintains 12.2 m (40 ft) of water through Tybee Roads, then 11.6 m (38 ft) for about 16 mi in the main channel to the turning basin at Kings Island (DOC, 1993d). A map of the port is shown in Figure D-29.

Under normal conditions, currents at the entrance to Savannah are 1.1 to 1.5 metric-sec (2.2 to 3.1 knots) during the ebb tide, and 0.8 to 1.2 metric-sec (1.6 to 2.4 knots) during the flood tide. It has been reported that currents in the river can reach 3.6 to 4.1 metric-sec (7 to 8 knots) in the vicinity of Garden City Terminal just below the Route 17A bridge and at the Colonial Oil Berths, about 4 km (2.5 mi) above the bridge. Access to the port can be complicated due to some relatively narrow sections of the channel combined with high currents (DOC, 1993d).

The Georgia Ports Authority (GPA) operates three large cargo terminals on the South Bank of the Savannah River. Ocean Terminal, located approximately 41 km (25 mi) from the river entrance in the City of Savannah, is a combination breakbulk and container handling facility; Garden City Terminal is about 4.6 km (2.9 mi) further upstream from Ocean Terminal. Containerport, part of the Garden City terminal complex, is a dedicated container handling facility. The depth alongside both container terminals is 11.6 m (38 ft), and dredging to 12.7 m (42 ft) is in progress.

The port is served by more than 50 container and breakbulk ship lines, including several major container carriers, with itineraries to some 100 countries in the world, including many in Europe and the Far East, as well as Japan, and Australia (Jane's, 1992; AAPA, 1993; Southern Shipper, 1993)

Ocean Terminal: This facility has 10 berths, a 61 m (200 ft) apron, extensive Transit sheds and warehouse space, with 34 ha (83 acres) of open storage. It has one 41 metric ton (45 ton) single hoist container crane and four gantry cranes of greater capacity, and 1,825 m (5,990 ft) of marginal wharf; Berth 13, the longest, is 297 m (975 ft) long. The terminal has almost immediate access to U.S. Route 17 (north/south), and connects with I-16 a few city blocks from the terminal. The terminal is served by the Norfolk Southern and CSX railroads (AAPA, 1993; Southern Shipper, 1993; Jane's, 1992). Due to its close proximity to the City, it is not a preferred container terminal.

Containerport: This is the preferred container terminal, due to its better separation from the City and modern facilities. It is located about 40 km (25 mi) from the Atlantic. It has 6 container ship berths, a 61 m (200 ft) apron, and a 457 m (1,500 ft) by 488 m (1,600 ft) turning basin. The terminal has a large Container Freight Station comprising 51,280 m² (552,000 ft²) for stuffing and stripping containers, with areas for segregating hazardous cargoes. The facility has 1,676 m (5,500 ft) of marginal wharf, and nine 40.8 metric ton (45 ton) single hoist container cranes. Truck access to the terminal is via limited access roads and lightly populated areas to the following expressways: about 13 km (8 mi) to I-16 (east/west); about 9.6 km (6 mi) to I-95 north and about 18 km (11 mi) to I-95 south. Containerport has excellent shipside rail service, consisting of a series of rail spurs at right angles to the container berths, providing direct ship-to-rail transfers. Onsite switching is provided by GPA's Savannah State Docks Railroad, connecting with the CSX and Norfolk Southern rail systems (AAPA, 1993; Southern Shipper, 1993; Jane's, 1992; GPA, 1994).

Other Pertinent Information: The port's Director of Public Relations was unaware of any ordinances or regulations prohibiting the receipt and handling of spent nuclear fuel, and the port does handle radioactive materials (Moore, 1993). The official did not know if the port had handled spent nuclear fuel, but data

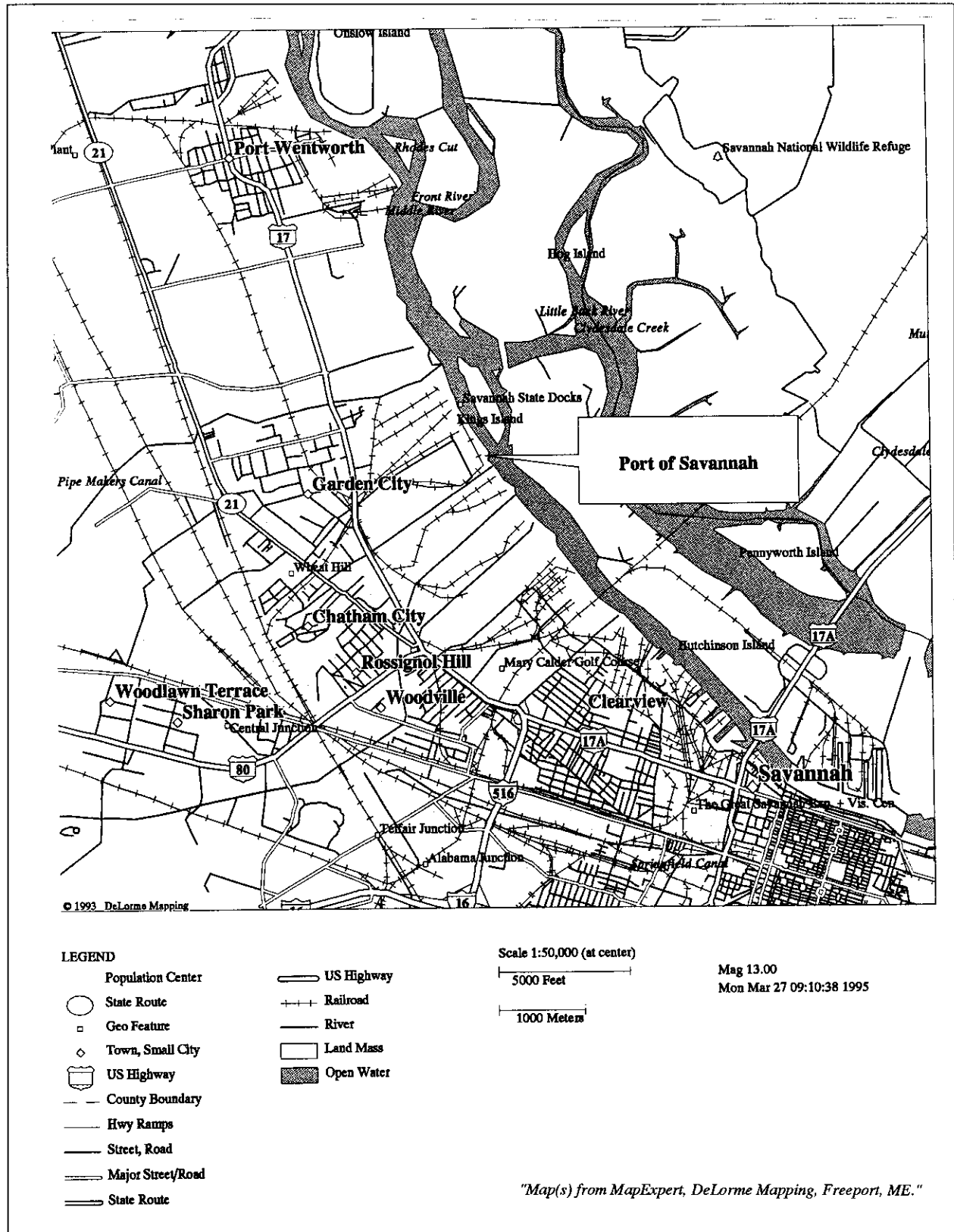


Figure D-29 Map of the Port of Savannah, GA

show it has (SNL, 1994; NRC, 1993). The port has a hazardous materials training staff but no Emergency Response Team. Reportedly, the GPA contracts with outside firms to respond to oil and other hazardous materials accidents.

There are tanker berths and petroleum storage facilities adjacent to Containerport's facilities, and there are several private bulk liquid storage facilities downstream of Containerport (towards the City), including a liquid natural gas terminal a few miles above the Pilot station. The presence of these terminals along a river channel only 152 m (245 ft) wide with swift currents, and the increasing number of container ships with lengths in excess of 250 m (820 ft) heighten the possibility of potentially serious conflicts within the port.

The port is subject to severe hurricanes and tropical storms, and given its proximity to Charleston, SC may have a slightly higher risk of earthquakes than the rest of the State of Georgia. The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Savannah, the Uniform Building Code requires buildings to withstand wind speeds up to 130 km/hr (80 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 155,166. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 37,300 ; Oak Ridge Reservation, 101,000; Idaho National Engineering Laboratory, 553,000; Hanford Site, 602,000; and Nevada Test Site, 616,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 400 km (250 mi); Oak Ridge Reservation, 720 km (449 mi); Idaho National Engineering Laboratory, 3,860 km (2,398 mi); Hanford Site, 4,530 km (2,813 mi); and Nevada Test Site, 4,020 km (2,501 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The lower Savannah River has multiple branches that meander through a variety of coastal lowlands including salt marshes, tidal creeks, freshwater marshes and freshwater impoundments. South Carolina has classified the portion of Savannah Harbor within its boundaries upstream from Fort Pulaski as Class B and the portion oceanward as Class SA. Class B waters are fresh waters suitable for secondary contact recreation, as a drinking water source following conventional treatment, fishing, industrial, and agricultural use. Class SA waters are defined as tidal saltwaters suitable for primary contact recreation, and for all the uses listed in Class B. The State of Georgia has classified the Savannah River from Mi 0 at Fort Pulaski north to Mi 5 at Field's Cut as recreation waters. North of Field's Cut, the waters are classified as Coastal Fishing (U.S. Army, 1991). According to the U.S. Fish and Wildlife Service's Ecological Inventory Map for Savannah, the Containerport is located in a transitional estuarine habitat where the salinity ranges from low (generally 0.5 to 5 parts per thousand) to mid-salinity (generally 5 to 16.5 parts per thousand) (FWS, 1980c).

A large number of aquatic and terrestrial species are found in and around the Savannah River near Garden City. The U.S. Fish and Wildlife Service indicated that the protected species most likely to be found on or near this general area include: the bald eagle, wood stork, shortnose sturgeon, west indian manatee, and eastern indigo snake. The bald eagle and wood stork occur on the Savannah National Wildlife Refuge. West indian manatees are known to use the lower Savannah River and are seen fairly often in the river and harbor area. The shortnose sturgeon uses the Savannah River as a migratory area. The lower Savannah

River also is reported to be an important spawning area for striped bass (Laumeyer, 1994). In addition, the loggerhead turtle, bald eagle, and the American alligator are found along the lower reaches of the Savannah River (FWS, 1980c).

Both invertebrate and fish species of commercial and recreational value found in the Savannah River. Commercial fishing is primarily for American shad, sturgeon, shrimp, and blue crab. Public shellfishing is allowed in some areas near the mouth of the Savannah River in the vicinity of Fort Pulaski. The Savannah River is host for the migration of several important commercial and game fishes including the American shad, the hickory shad, and the blueback herring. Game species include the spotted seatrout, red drum, croaker, spot, striped bass, flounder, silver perch, white catfish, channel catfish, large mouth bass, sunfish, and crappies. The State of Georgia has closed the striped bass fishery for population recovery purposes. Results of a seasonal creel survey of the Savannah River estuarine fishery, conducted by the Georgia Department of Natural Resources from October 20, 1992 to February 16, 1993 found that the estimated angler harvest for that time period was 10,893 fish. White catfish (28.4 percent), spotted seatrout (27.9 percent), red drum (17.9 percent), and silver perch (10.4 percent) represented approximately 85 percent of the fish harvested from the Savannah River during this time period (Schmitt, 1993).

There are several wildlife refuges and/or game management areas located along the lower portion of the Savannah River. Tybee National Wildlife Refuge is located at the mouth of the Savannah River at the confluence with the Atlantic Ocean. Just north of Tybee National Wildlife refuge is the Turtle Island Game Management Area. The Containerport itself is located across the river from the southern end of the 10,371 ha (25,608 acre) Savannah National Wildlife Refuge. The Savannah National Wildlife Refuge and the Tybee National Wildlife Refuge are managed by the U.S. Fish and Wildlife Service.

Climatic Conditions

The Port of Savannah, GA, is located in Chatham County on the Savannah River. The city of Savannah is surrounded by low, flat terrain that is marshy to the north and east and rises to a few meters (several ft) above sea level to the west and south.

The area has a temperate climate which, again, is greatly influenced by winds coming into the area off of the surrounding ocean. Nominally, 50 percent of the rainfall occurs during thunderstorms with the remainder being equally distributed over the year and generally related to frontal passages. Severe tropical systems affect the Savannah, GA, area roughly once every 10 years and cause heavy, sustained precipitation, high winds, and extreme localized coastal flooding. Rainfall measurements in excess of 51 cm (20 in) have been observed as a result of tropical systems impacting the area. Based on the 1951-1980 climatology, the first freeze occurs on average around November 15th and the last freeze occurs near March 10th (NOAA 1992d).

D.2.1.9 Tacoma, WA

The Port of Tacoma is located in the southeastern corner of Puget Sound on the deep waters of Commencement Bay, about 5 km (3 mi) from the Sound. It is a rapidly expanding major port, second only to Seattle in maritime importance on Puget Sound. Like Seattle, access is gained via the Straits of Juan de Fuca and Puget Sound. The distance from the entrance into Puget Sound is approximately 130 km (80 mi). While the transit is open with deep wide channels, it is a relatively long distance on an inland waterway (DOC, 1992b). The port currently handles about 1,054,000 20-ft equivalent container units, amounting to 6.7 million metric tons (7.4 million tons) of cargo (AAPA, 1994). A map of the port is shown in Figure D-30.

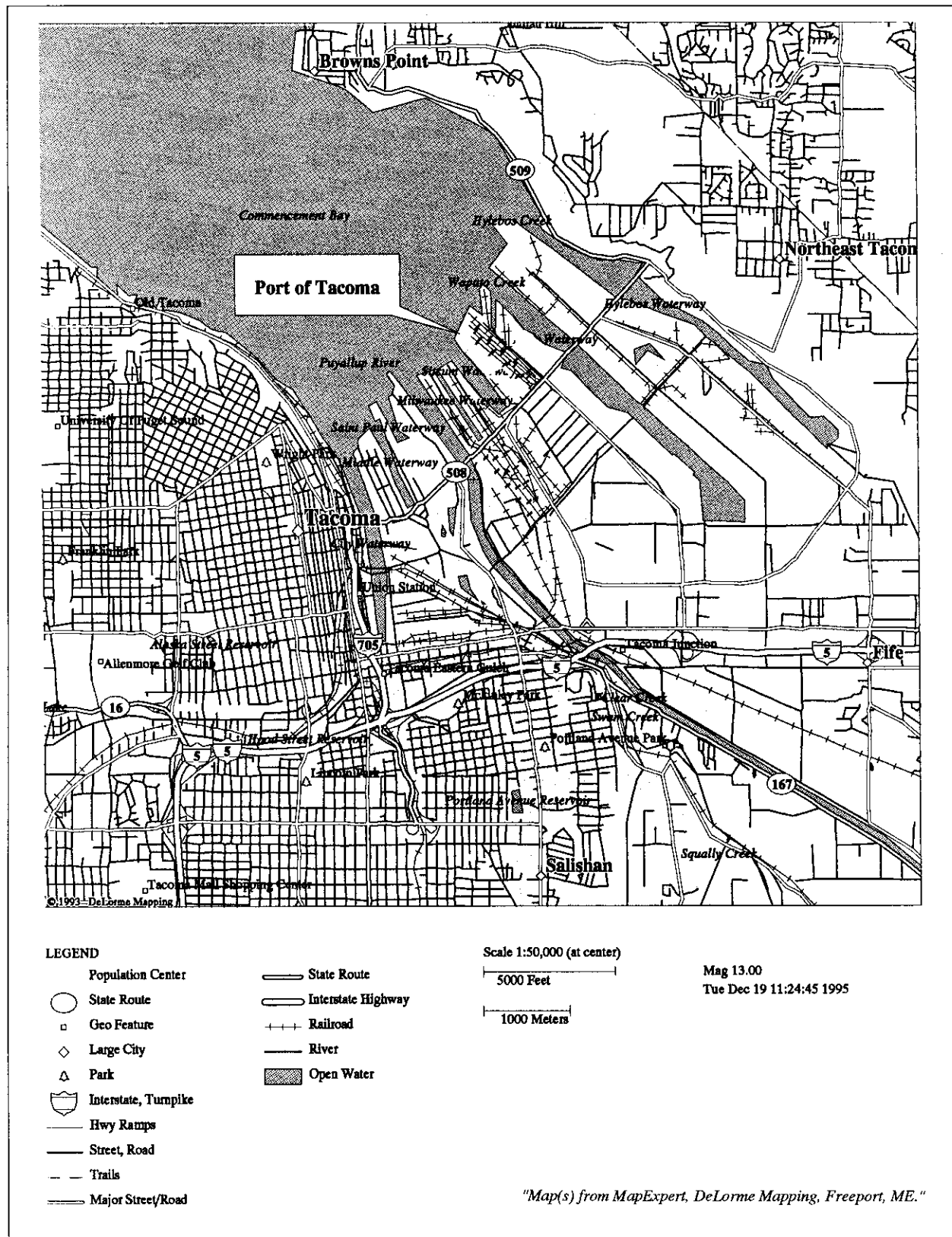


Figure D-30 Map of the Port of Tacoma, WA

The port functions as a special purpose district operation under State enabling legislation and is governed by a Board of Commissioners. The Commission owns and operates several terminals, including container and roll-on/roll-off facilities. Stevedoring is performed by private contractors and/or by ship lines leasing facilities from the port.

Commencement Bay has been designated a "Superfund Site" by the Environmental Protection Agency. However, since the acceptance of spent nuclear fuel through the Port of Tacoma would neither affect the activities being conducted in response to the "Superfund Site" designation, nor would it add any additional burden to this designation, the "Superfund Site" designation has no bearing on the proposed action.

Berths A, B, and C of Terminal 7 are primarily public general cargo facilities handling breakbulk and dry bulk cargoes. Depths alongside range from about 12.2 m to 15.2 m (40 to 50 ft), and it has two 36 metric ton (40 ton) gantry cranes and one 36 metric ton (40 ton) multi-purpose bulk unloading crane. Terminal 7, Berth D (Husky Terminal) is the primary container terminal, and has one 274 m (900 ft) long container berth, 3 container cranes [two 45 metric ton (50 ton) and one 50 metric ton (55 ton)], and 15.2 m (50 ft) of depth alongside at mean low water. It has 14 ha (33 acres) of terminal area with access to the 9,512 m² (102,400 ft²) container freight station and a 8,920 m² (96,000 ft²) transit warehouse located near Berths A and B.

The Husky Terminal is about 4.8 km (3 mi) from the Port of Tacoma road access (Exit 136) to Interstate 5 immediately outside the port complex. While a somewhat longer route, Interstate 5 South connects with I-84 East near Portland, OR, avoiding the added risks of trucking spent nuclear fuel over Snoqualmie Pass to Eastern Washington during the winter. Ship berths are served by the Port Belt Line Railroad, and the port is served by the Burlington Northern and Union Pacific Railroads, which interline with eastern and southern railroads. All Terminal 7 berths are adjacent to the North Intermodal Railroad Yard, which consists of 10.4 ha (26 acres) of yard area and 5,340 m (17,500 ft) of trackage. A second intermodal rail terminal, the South Intermodal Rail Yard, is also located within the port for use by all port shippers (Jane's, 1992; AAPA, 1993; POT, 1994).

Tacoma is served by over a dozen containership and breakbulk ship lines including ELMA, Evergreen, Hyundai, IMT, "K" Line, Maersk, MOL, Navianca, Naviera Pacifico, NOSAC, PCL, Sea-Land, South Pacific Interline, Totem Ocean Trailer Express, Wallenius, and Wallno (Jane's, 1992; AAPA, 1993). These lines provide service with most of the Pacific Rim, including Australia and Japan, and also have service with the Mediterranean (Jane's, 1992; AAPA, 1993).

Other Pertinent Information: According to the port's Director of Risk Management, shipments of spent nuclear fuel could be prohibited by the City of Tacoma Harbormaster's Office, but no formal regulatory restriction was identified. The port has had no identifiable experience with shipment of spent nuclear fuel (SNL, 1994; Paulsen, 1993; NRC, 1993). Security is maintained at Terminal 7 by the port Police around the clock, with locations for segregation and temporary storage of hazardous cargoes (special guards would have to be provided by the shipper for spent nuclear fuel) (Paulsen, 1994). The Tacoma Fire Department provides response for accidents, and the port security personnel are trained in emergency response in cooperation with the Fire Chief (McLendon, 1994). There is also the possibility that the Husky Terminal may begin handling ammonium nitrate in bulk, which (because of the explosion potential) would have to be considered in the event the port were to receive spent nuclear fuel shipments (Paulsen, 1994). The U.S. Coast Guard accident statistics for the period 1991-1993 for the Puget Sound indicate a total of 54 reportable accidents (USCG, 1994b). Given the high volume of ship traffic, the accident frequency is considered to be low.

As is the case with Seattle, there is substantial environmental concern about environment damage, and the entire Puget Sound area is subject to severe earthquakes and volcanism. The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Tacoma, the Uniform Building Code requires buildings to withstand wind speeds up to 130 km/hr (80 mph). The port is located in a high seismic zone with an acceleration of 0.30 g. There have been two major earthquakes in the Puget Sound area this century; a modified Mercalli intensity VII on April 13, 1949 and a modified Mercalli intensity of VIII on April 29, 1965 (Bolt, 1978). On May 18, 1982, Mount Saint Helens suffered a major volcanic eruption (IPA, 1993). All the mountains along the Cascades Range, from Canada to Northern California, are volcanic in origin, and potentially active (Foster, 1971; Hamilton, 1976; IPA, 1993).

The 1990 population within 16 km (10 mi) of the port terminals was 511,575. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 601,000; Oak Ridge Reservation, 431,000; Idaho National Engineering Laboratory, 157,000; Hanford Site, 98,600; and Nevada Test Site, 379,000. Populations along rail routes to four of these sites are slightly larger, but the population along the rail route to Nevada Test Site is slightly smaller (this is largely due to primary use of interstate highways through Salt Lake City and Las Vegas, use of U.S. 95 south from Oregon would reduce the population along truck routes. These populations are shown in Tables D-6 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 4,720 km (2,931 mi); Oak Ridge Reservation, 4,280 km (2,658 mi); Idaho National Engineering Laboratory, 1,310 km (815 mi); Hanford Site, 399 km (248 mi); and Nevada Test Site, 2,160 km (1,344 mi). Distances along rail routes are longer.

Environmental Conditions

A variety of aquatic species are found in Puget Sound. Several animal species, with special status, may also be found in this area. A variety of marine mammals can be found in the central Puget Sound including the Pacific harbor seal, California sea lion, killer whale, Dall porpoise, and harbor porpoise. In 1991, the U.S. National Marine Fisheries Services reported that the following endangered and/or threatened species may occur in the Puget Sound: the endangered gray whale, the endangered humpback whale, the threatened Stellar sea lion, and the endangered leatherback sea turtle (DOE, 1995). These species are not reported at the port. The U.S. Fish and Wildlife Service reported that the bald eagle and marbled murrelet, both listed protected species, may occur in the vicinity of the port (Frederick, 1994). Bald Eagles can be found throughout this coastal zone, and American peregrine falcons are uncommon winter visitors (FWS, 1981a). The U.S. Fish and Wildlife Service's Ecological Inventory for the Puget Sound area indicates that the habitat of Commencement Bay is used by a variety of birds including: shorebirds, gulls, sandpipers, turnstones, yellowlegs, herons, rails, great blue herons, waterfowls, loons, grebes, swans, geese, dabbling ducks, diving ducks, mergansers, American widgeons, pintails, mallards, seabirds, cormorants, alcids, common murre, and the pigeon guillemot. Adult concentrations of all of these species may be found in the Bay. Some of these species may also use this area as an overwintering area, a migratory area, and/or a nesting area (FWS, 1981a). It is also indicated that adult concentrations of Chinook salmon, coho salmon, chum salmon, and pink salmon are found in the Puyallup Waterway/River and use this water body and upstream segments as migratory and nursery areas.

According to the State of Washington's Department of Wildlife, a number of seabird colonies exist along the shoreline of Commencement Bay. Areas of the Puget Sound, north of Commencement Bay, are also used as haulouts by the California sea lion. Areas of estuarine wetlands are located along the northern shore of Commencement Bay (WDW, 1994b).

Commencement Bay has been designated a "Superfund Site" by the Environmental Protection Agency. However, since the acceptance of spent nuclear fuel through the Port of Tacoma would neither affect the activities being conducted in response to the "Superfund Site" designation, nor would it add any additional burden to this designation, the "Superfund Site" designation has no bearing on the proposed action.

Climatic Conditions

See Section D.2.2.21 (Seattle) for climatic information, since conditions in Tacoma, WA are essentially the same.

D.2.1.10 Wilmington, NC

The Port of Wilmington, NC is located on the east bank of the Cape Fear River, about 42 km (26 mi) above its mouth on the Atlantic Ocean. It is the leading port of North Carolina, and its major export is wood pulp. It handles about 110,000 20-ft equivalent units per year, representing about 30 percent of total tonnage. The major terminals are down river from the city. A Federal project maintains a 12.2 m (40 ft) channel over the ocean bar into the Cape Fear River, and then 11.6 m (38 ft) to the port. A new dredging program will deepen the approach channel to 12.2 m (40 ft). The approach to Wilmington, up the Cape Fear River, is more open than many river approaches but has restricted segments. The minimum channel width is about 120 m (400 ft). Currents in the river conform to the channel (DOC, 1993d; FHI, 1993c; NCSPA, 1994). A map of the port is shown in Figure D-31.

The port is owned and operated by the North Carolina State Ports Authority (NCSPA), a State agency. It is a modern container and general cargo facility with over 92,900 m² (more than a million ft²) of covered, sprinklered storage and a total of 11 berths, two of which are open. The port has over 40 ha (100 acres) of paved, open area and 10 ha (25 acres) of semi-improved storage area. The Wilmington wharves are of concrete pile construction, rubber fendered, with a total frontage of about 2,000 m (6,568 ft). Berths 6 to 9 are dedicated containership berths with the remaining berths used for various kinds of general cargo. All of the main cargo berths have a depth alongside at mean low water of 11.6 m (38 ft). The terminal has three, 40.6 metric ton (45 ton) container cranes and two, 50.8 metric ton (56 ton) container cranes, plus three gantry cranes ranging from 40.8 metric ton (45 ton) to 204 metric ton (225 ton) (Jane's, 1992; AAPA, 1994; FHI, 1993c; NCSPA, 1994).

Terminal access via truck is through the controlled South Gate Container Entrance. Truck shipments of spent nuclear fuel from Wilmington to southern destinations are from U.S. Routes 17, 74, 76 and 421 to Interstates 95 and 40. The local routes are accessed about 3 km (2 mi) north of the terminal where they cross the Cape Fear River using the lift bridge. Northern and western long distance routes are via Interstate 40 which connects with State Highway 132 about 16 km (10 mi) north of the city. Wilmington container berths are served shipside by the port rail system and the CSX Railroad. There is also an intermodal trailer-on-flat-car and container-on-flat-car rail yard within the container port. While not currently operational, the port is negotiating with CSX for resumption of intermodal rail service at that facility. At the present time, most rail cargo which requires intermodal connections is trucked to the Charlotte Intermodal Terminal (Wilson, 1995).

The port is serviced by over 30 container lines, including Yang Ming, Polish Ocean, Allied Scandinavian, Central Gulf, Zim, Hanjin and Turkish Cargo Line, plus several regularly scheduled breakbulk shipping companies. These lines provide service from Northern Europe, the Mediterranean, Mideast, East and South Africa, South America, the Far East, Australia, and other shipping centers of the world (Southern Shipper, 1993; Jane's, 1992).

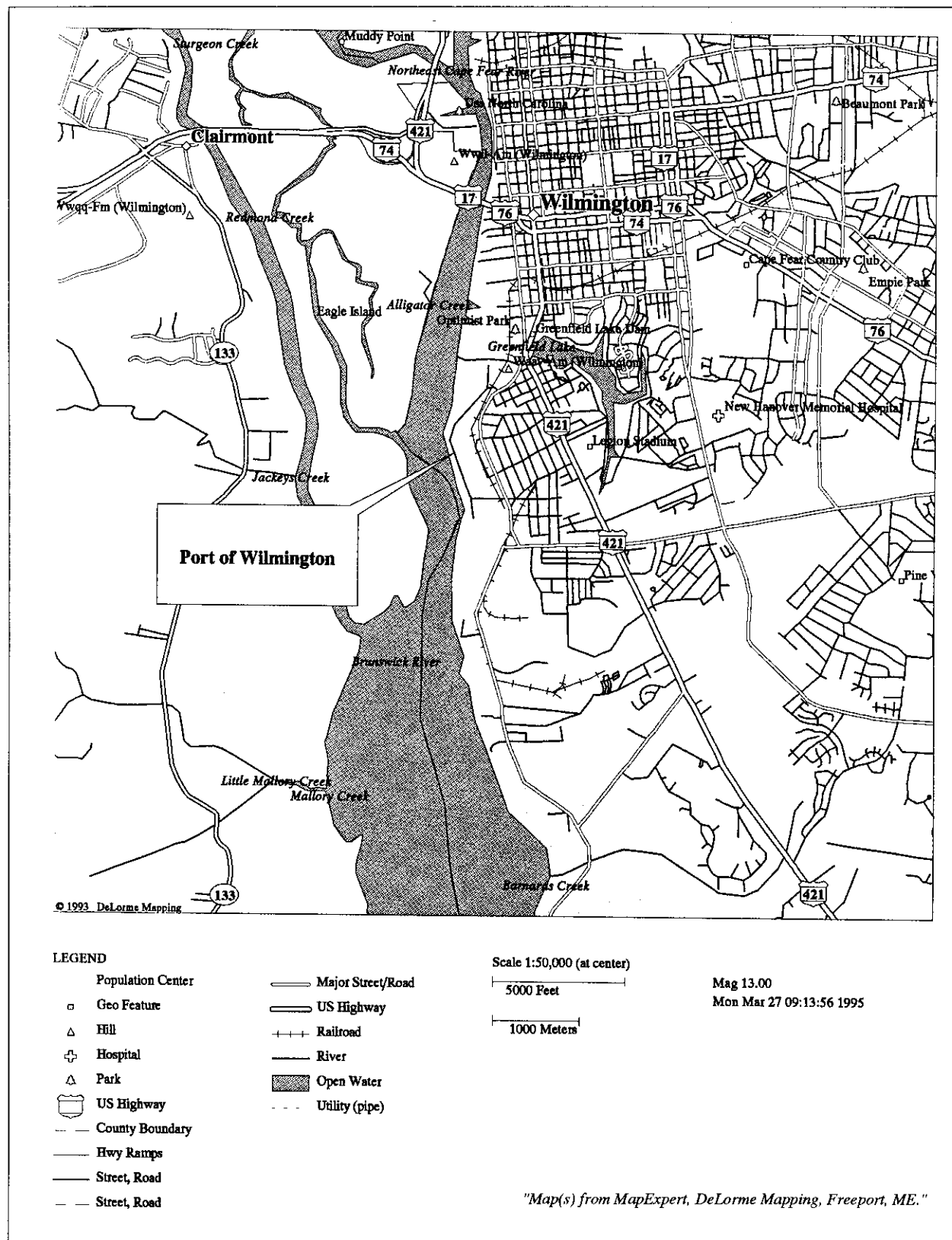


Figure D-31 Map of the Port of Wilmington, NC

Other Pertinent Information: There are no known restrictions on the receipt and handling of spent nuclear fuel through the port, although the Mayor has provided notice that the city is not convinced that the port is desirable for spent nuclear fuel shipments (Betz, 1994). This position was echoed by the Port's Executive Director, who noted that permission to visit the port must come from the State Port Commission, and that the Governor was opposed to handling spent nuclear fuel at State ports (Scott, 1994). Wilmington has handled the import shipments of enriched uranium for nuclear fuel fabrication consigned to a General Electric commercial nuclear fuel fabrication plant north of Wilmington, the exports of the finished nuclear fuel assemblies, and has also handled containerized Class A explosives (Wilson, 1993). The Sandia National Laboratories Radioactive Materials Postnotification Database was queried in April 1994, and the data showed that Wilmington received two shipments of spent nuclear fuel from Japan on February 3, 1986 and transhipped the casks to Savannah River Site the same day (SNL, 1994).

The port is located several miles downstream of the business district in an area of increasing industrial development, although there is some residential housing bordering the complex. The Military Ocean Terminal at Sunny Point is also located on the Cape Fear River, north of Southport, NC, and south of Wilmington, NC.

Port officials are part of an emergency response team headed by the Coast Guard and the Wilmington Fire Department. There are two fire stations within 3 km (2 mi) of the port, with a 5-minute response time (Scott, 1994). All operational personnel working within the terminal, including longshoremen, are given basic hazardous materials training, but training does not deal specifically with spent nuclear fuel.

Security at the port is provided by a 2 m- (6 ft-) high perimeter fencing topped with barbed wire, and a North Carolina State Ports Authority Police Force, which maintains a 24-hour patrol and surveillance. Armed officers are commissioned by the City Police Department, and unarmed guards at the gates are employed by the port (Scott, 1994). A North Carolina State Ports Authority Safety Manager reports to the Director of Operations and is responsible for all safety aspects of the terminal. A tanker terminal and petroleum storage depot are located immediately adjacent downstream of the port. Immediately north of the terminal, on the same side of the river, is an asphalt and chemical storage marine terminal. There is little ship traffic on the River, north or south of the State docks, and therefore there is little conflicting traffic or cargoes.

There are no known environmentally sensitive areas in the immediate vicinity of the terminal, but due to area resorts and recreational activity, there is heightened environmental awareness. The port is subject to hurricanes and tropical storms, as discussed below.

The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Wilmington, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 115,057. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 64,700; Oak Ridge Reservation, 128,000; Idaho National Engineering Laboratory, 507,000; Hanford Site, 556,000; and Nevada Test Site, 570,000. Populations along rail routes to these sites are slightly longer. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 500 km (310 mi); Oak Ridge

Reservation, 820 km (509 mi); Idaho National Engineering Laboratory, 4,100 km (2,546 mi); Hanford Site, 4,770 km (2,963 mi); and Nevada Test Site, 4,260 km (2,650 mi). Distances along rail routes are slightly longer for Western sites, but about the same for Eastern sites.

Environmental Conditions

North Carolina has given the lower portion of the Cape Fear River three different stream classifications. From the Northeast Cape Fear River to the confluence with the Cape Fear River the waters are classified as SC-swamp. From the mouth of the Northeast Cape Fear to a point between Snow and Federal Points, the waters are classified as SC. From Snow and Federal Points oceanward the waters are classified as SA. SC waters are tidal waters suitable for fishing, fish and wildlife propagation, secondary recreation and other water uses requiring lower quality. The term "swamp" denotes waters with slow velocity. Class SA waters are suitable for shellfishing, primary recreation, as well as all of the activities approved for Class SC waters (NCDEHNR, 1992). According to the U.S. Fish and Wildlife Service's Ecological Inventory Map for Beaufort, NC, the Port of Wilmington is located in a low salinity estuarine habitat (generally 0.5 to 5 parts per thousand) and tidal freshwater habitat. Below Wilmington at Campbell Island, the river changes to a mid-salinity estuarine habitat (generally 5 to 16.5 ppt). The Cape Fear River near MOTSU changes once again to a high salinity estuarine habitat (generally 16.5 to 30 ppt) (FWS, 1980a).

The lower Cape Fear River supports a large number of aquatic and terrestrial species. There are both invertebrate and fish species of commercial and recreational value found in the Cape Fear River near the Port of Wilmington. Species sought by commercial and recreational fisherman include flounder, trout, spot, croaker, bluefish, Spanish mackerel, and king mackerel. Shellfish sought include penaeid shrimp and blue crabs.

The Natural Heritage Program of the North Carolina Department of Environment, Health, and Natural Resources reports that the area around the state port has not been systematically inventoried for rare species (Smith, 1994). However, DEHNR reports that the lower Cape Fear River, from Wilmington to the mouth of the river at Smith Island, is brackish and contains numerous rare animals. The shortnose sturgeon (State and Federal Endangered Species) rarely occurs in the river, whereas manatees (State and Federal Endangered Species) occasionally occur, especially in the summer. American alligators (State and Federal Threatened Species) can be found in tributary streams. The freckled blenny, spinycheek sleeper, opossum pipefish, and marked goby are other rare marine fishes that inhabit the river.

A large number of aquatic species may be found in the lower Cape Fear River and along the southern coast of North Carolina (Horning, 1994; U.S. Army, 1993; FWS, 1980a). There are many animals with special status in this area, including various types of whales, sea turtles, and birds. State or Federally protected endangered or threatened aquatic species in this area include the shortnose sturgeon (fish), finback whale, Florida manatee, humpback whale, right whale, sei whale, and sperm whale (mammals), Arctic peregrine falcon, bald eagle, piping plover, red-cockaded woodpecker, wood stork (birds), and the American alligator, green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle and the loggerhead sea turtle (reptiles and amphibians).

Climatic Conditions

The elevation of this region is approximately 12 m (40 ft) above sea level and is more variable than the coastal plain surrounding the Norfolk, VA, area.

The maritime location of the Wilmington, NC, area makes the climate unusually mild for its northern latitude. All wind directions from the east-northeast through the southwest have some moderating effect on the local climate, due to the relatively warm and cool ocean in the winter and summer seasons, respectively. The area rarely experiences cold episodes where the temperature falls below -18°C (0°F). However, cold air outbreaks do occur, causing sharp fluctuations in winter temperatures. Rainfall in the area is generally considered ample and evenly distributed throughout the year, with the bulk of the precipitation occurring during the summer months. The bulk of this rainfall is generally associated with afternoon and evening thunderstorms. In contrast, the winter rains tend to be of the slow, steady type lasting, generally, one to two days. As is common at Atlantic coastal localities at this latitude, the late summer and early fall months bring the possibility of hurricanes and tropical storms to the Wilmington, NC area. These storms are capable of generating high winds, above normal tides, and torrential rains. The latter two are also capable of creating widespread local flooding of low-lying coastal areas (NOAA, 1992b).

D.2.2 Other U.S. Ports Meeting the Appropriate Experience Criteria

The ports described in this section are those that were initially identified as acceptable based on experience with containerized cargo, but that were subsequently dropped from further consideration based on evaluation against other criteria. Those criteria and the evaluation process are described in Section D.1.

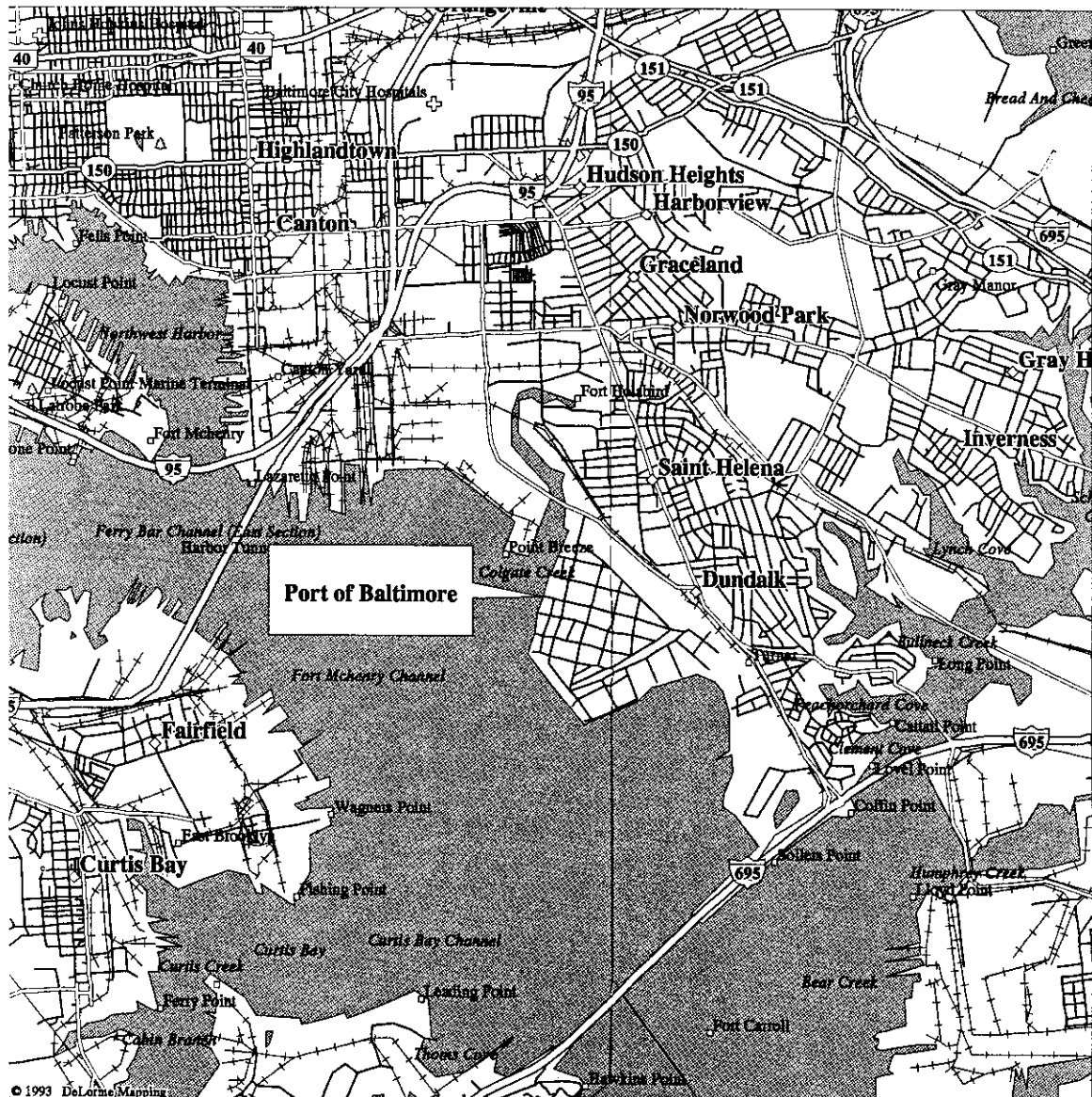
D.2.2.1 Baltimore, MD

The Port of Baltimore, one of the major ports of the United States, is established on the upper Chesapeake Bay at the head of tidewater navigation on the Patapsco River. It is situated 13 km (8 mi) from the entrance to the Patapsco, 240 km (150 mi) from the Virginia Capes, and 1670 km (104 mi) from the Delaware Capes.

Depths within the harbor range from 15.2 m (50 ft) to 12.2 m (40 ft). Federal project depths are 15.2 m (50 ft) in the main channel between the Virginia Capes and Fort McHenry in the Baltimore Harbor. Access to the port can be gained via the Delaware Bay and River, and the Chesapeake and Delaware Canal, although this route is not recommended due to the restrictive nature of the transit. The preferred route is via the Virginia Capes and Chesapeake Bay. The Chesapeake Bay is considered part of the transit to Baltimore; this includes 240 km (150 mi) up the Bay under the Chesapeake Bay Bridge to the Patapsco River (DOC, 1993c). A map of the Port of Baltimore is shown in Figure D-32.

In the Port of Baltimore, the Maryland Port Administration (MPA) owns and operates the two principal general cargo terminals — Seagirt and Dundalk Marine Terminals. Together these terminals provide a total of 338 ha (835 acres) of cargo handling space on deepwater channels. Both terminals are ports of call for many of the world's largest container and roll-on/roll-off shipping lines. Seagirt is capable of handling (length and draft) the largest post-Panamax vessels currently in service (Jane's, 1992; AAPA, 1993; D&B, 1993).

Seagirt Terminal: Seagirt is MPA's newest and most modern container facility with three container ship berths, eight cranes, and 107 ha (265 acres) of developed terminal area. Seagirt also has a deeper water depth alongside berths; the three container berths have a depth alongside at mean low water of 12.8 m (42 ft). The terminal has two 313 m each (1,020 ft each) marginal wharves and one 326 m (1,070 ft) marginal wharf. Crane capacity at the terminal consists of four 50.8 metric ton (56 ton) single hoist container cranes, three 50.8 metric ton (56 ton) double hoist container cranes, and one 27.9 metric ton (30.7 ton) single hoist container crane (AAPA, 1993 and 1994; Jane's, 1992; D&B, 1993).



LEGEND

- | | |
|------------------------|---------------------------|
| Population Center | — River |
| □ Geo Feature | ■ Open Water |
| ◇ Town, Small City | - - - Intermittent River |
| ◡ Interstate, Turnpike | - - - Utility (powerline) |
| — County Boundary | |
| — Hwy Ramps | |
| — Street, Road | |
| — Major Street/Road | |
| — Interstate Highway | |
| — Railroad | |

Scale 1:50,000 (at center)

5000 Feet

1000 Meters

Mag 13.00

Sun Mar 26 13:08:09 1995

"Map(s) from MapExpert, DeLorme Mapping, Freeport, ME."

Figure D-32 Map of the Port of Baltimore, MD

Dundalk Marine Terminal: Dundalk Marine Terminal, located adjacent and eastward of Seagirt, has approximately 231 ha (570 acres) of terminal area and is a combination container, roll-on/roll-off, and breakbulk handling facility. The terminal has 13 barge and ship berths, 11 cranes, and covered storage shed space of more than 37,000 m² (400,000 ft²). Marginal wharves consist of three 808 m total (2,650 ft), two 553 m total (1,820 ft) container berths, and one 305 m (1,000 ft) container berth. Containership berths have a depth alongside of 11.5 m (38 ft). Crane capacity at the terminal includes nine 40.6 metric ton (45 ton) single hoist container cranes and two 61 metric ton (67 ton) gantry whirley cranes (Jane's, 1992; D&B, 1993; AAPA, 1993 and 1994).

The Seagirt and Dundalk Terminals are located in the Dundalk section of the City of Baltimore, east and south of the central business district. The access road to both terminals is bordered primarily by heavy industrial types of businesses with relatively good interstate highway connections. Southbound, the distance from Seagirt to I-695 is roughly 4 km (2.5 mi). The entrance to the Seagirt Marine Terminal is approximately 1.6 km (1 mi) from I-95 connected by Bruening Highway, an industrial roadway that also serves as the main truck access to both terminals. Access to other major interstate highways is via the I-695 Beltway, which would be used to bypass harbor tunnels for Savannah River Site or other southern destinations. Routing and connect time for Dundalk traffic would be virtually the same due to proximity of location to the Seagirt terminal. Seagirt is served by the CSX Railroad, which operates a 16.2 ha (70 acre) intermodal container transfer facility inside the terminal and within 0.3 km (1000 ft) of the ship berths. Conrail serves the Dundalk Terminal for breakbulk cargoes (D&B, 1993; AAPA, 1993 and 1994).

Other Pertinent Information: Security of both terminals is maintained by the MPA Port Police and is deemed to be excellent. There are secure areas for temporary segregation and storage of containers if necessary.

There are no port restrictions against handling spent nuclear fuel. A port safety officer stated that spent nuclear fuel shipments go out of the port with an armed escort (normally at night), and that the port also handles casks (cylinders) of uranium hexafluoride (UF₆) shipments quite frequently. Although there are no known conflicts with other hazardous materials in the immediate terminal area, there is a diversity of marine terminals and ship traffic activity on the Patapsco River which are not deemed to represent a major hazard factor.

There are no known special environmental issues with regards to handling spent nuclear fuel at Baltimore. The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Baltimore, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (70 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The MPA relies on the hazardous materials teams of the Baltimore City and County fire departments as well as the Coast Guard for response to hazardous materials accidents. The Maryland Department of the Environment also has input on hazardous materials problems. The MPA has an ongoing hazardous materials training program for all port operating personnel, including the longshoremen. Instruction includes dealing with hazardous wastes (but not spent nuclear fuel in particular) in the soil and groundwater due to the former use of the port site.

The 1990 population within 16 km (10 mi) of the port terminals was 1,182,024. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 308,000; Oak Ridge Reservation, 246,000; Idaho National Engineering Laboratory, 482,000; Hanford Site, 531,000; and Nevada Test Site, 665,000. Populations along rail routes to these sites are

much larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,020 km (636 mi); Oak Ridge Reservation, 925 km (575 mi); Idaho National Engineering Laboratory, 3,790 km (2,354 mi); Hanford Site, 4,460 km (2,770 mi); and Nevada Test Site, 4,060 km (2,526 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The Gunpowder Falls State Park is located approximately 22 km (13 mi) northeast of the port. The Remington Farms Wildlife Reserve, on the Eastern Shore of Maryland, is approximately 35 km (23 mi) east of the port. The Eastern Neck National Wildlife Refuge is located in the Chesapeake Bay, about 38 km (25 mi) southeast of the port area. The Fort McHenry National Monument and Historic Shrine is located on a point of land approximately 4 km (2 mi) west of the Baltimore port. Numerous State Parks and other wildlife refuges are located along the passageway in the Chesapeake Bay south of the port.

The endangered peregrine falcon occurs in the vicinity of the Port of Baltimore (Wolflin, 1994). These birds feed, in part, on shorebirds and other waterbirds using the waters of the Port of Baltimore. The endangered Delmarva fox squirrel and the great blue heron (State-protected) nest on the Eastern Neck Island (FWS, 1980g). The bald eagle (endangered) also nests in the Eastern Neck Island area.

The Bay contains many beds of commercially valuable oysters and soft-shelled clams. Blue crabs are harvested extensively throughout the Bay area. Commercial harvesting of channel catfish and menhaden also is important in the Bay area. Numerous types of fish use the Bay area, including the waters around the port, for nursery areas. Common fish species include the American eel, blueback herring, hickory shad, alewife, gizzard shad, perch, striped bass, drum, flounder, and others. Sport fishing for these fish is also common. State-protected species include the Atlantic sturgeon and American shad (FWS, 1980g). The western bank of the Eastern Shore is a migratory area for the dabbling duck (nonendangered) and a heavily used migration pathway for geese.

Climatic Conditions

Baltimore is in a region about midway between the rigorous climates of the North and the mild climates of the South and adjacent to the modifying influences of the Chesapeake Bay and Atlantic Ocean to the east and the Appalachian Mountains to the west. The net effect is to produce a more equable climate compared to inland locations of the same latitude.

Rainfall distribution throughout the year is rather uniform; however, the greatest intensities are confined to the summer and early fall, the season for hurricanes and severe thunderstorms. Rainfall during this period occurs principally in the form of thundershowers, and rainfall totals during these months vary appreciably, depending on the number of thundershowers that occur largely by chance in a given locality. Hurricane-force winds, however, may occur on rare occasions due to a severe cold front or a severe thunderstorm. The greatest damage by hurricanes is that produced along waterfronts and shores by the high tides and waves.

In summer, the area is under the influence of the large semipermanent high-pressure system commonly known as the Bermuda High and centered over the Atlantic Ocean near latitude 30°N. This high-pressure system brings a circulation of warm, humid air masses over the area from the deep South. The proximity of large water areas and the inflow of southerly winds contribute to high relative humidities during much of the year.

January is the coldest month, and July the warmest. Winter and spring have the highest average windspeeds. Snowfall occurs on about 25 days per year on the average; however, an average of only 9 days annually produce snowfalls greater than 1.0 in. Although heaviest amounts of snow generally fall in February, occasional heavy falls occur as late as March. Records for the period August 1950 through December 1967 indicate that the average date of the last temperature as low as 32° in the spring is April 15, while the average date of the first temperature as low as 32° in the autumn is October 26 (NOAA, 1993a).

Glaze or freezing rain occurs on an average of two to three times per year, generally in January or February, although some occurrences have been noted in November and December. Some years pass without the occurrence of freezing rain, while in others it occurs on as many as eight to ten days. Sleet is observed on about five days annually. The sleet season begins as early as November in some years, and ends as late as March in some cases, with the greatest frequency of occurrence in January (DOC, 1993c).

D.2.2.2 Boston, MA

The Port of Boston is located on Massachusetts Bay about 93 km (50 mi) west of Cape Cod and is the largest seaport in New England. Boston North Channel is the main entrance to Boston Harbor and Boston South Channel and The Narrows are alternative entrances. A Federal project on the North Channel (to the Mystic River) provides for a channel width of 460 m (1,500 ft) and a depth of 12.2 m (40 ft) in the eastern section, and a width of 270 m (900 ft) and depth of 10.7 m (35 ft) in the western section (DOC, 1993a).

Although there are many obstructions in the Harbor approaches, they are marked by a number of powerful lights, and the principal dangers are buoyed. Because of the heavy traffic to the Harbor, there is a traffic separation scheme extending over 160 km (100 mi) out to sea (DOC, 1993a).

The Massachusetts Port Authority (Massport) is a quasi-governmental authority created by the State Legislature in 1956. The Maritime Division is responsible for the operation, development, and maintenance of the port's three public terminals, including two container terminals (Moran and Conley) and one general cargo facility (Harbor Gateway Terminal) (POB, 1993). A map of this port is provided in Figure D-33.

Moran Terminal: Moran Terminal is located about 7.2 km (4.5 mi) upstream of the Inner Harbor Entrance, on the left side of the ascending bank of the Mystic River in Boston's Charlestown section. It is the largest container terminal in New England and is operated by Massport. The facility consists of 20.2 ha (50 acres) of open storage space, storage capacity for 4,000 20-ft equivalent units, and two container cranes [46 and 71 metric tons (51 and 78 tons)]. It has 335 m (1,100 ft) of marginal wharf and depth alongside of 12.2 m (40 ft). Vessels are limited by the 41.2 m (135 ft) clearance under the Tobin Memorial Bridge (Jane's, 1992; AAPA, 1993 and 1994; D&B, 1993; POB, 1993).

Moran Terminal is situated about 1.6 km (1 mi) from the intersection with I-93 with access via city streets through the densely populated Charlestown area. The terminal is served by the Boston & Maine Railroad, whose tracks enter the terminal and extend to the pier apron.

Conley Terminal: The Conley Terminal on Castle Island is less than 6.4 km (4 mi) from the designated entrance to Boston Harbor. The northern approach to the terminal is obstructed by islands and shoals that extend 6.4 km (4 mi) from the entrance for a combined distance of about 13 km (8 mi). It is located at the entrance of the Inner Harbor on the South Boston waterfront. The Terminal is operated by a subcontractor to Massport. It has 305 m (1,000 ft) of marginal wharf, and consists of Berths 11-15, and Berth 17. The depth alongside is 12.2 m (40 ft).

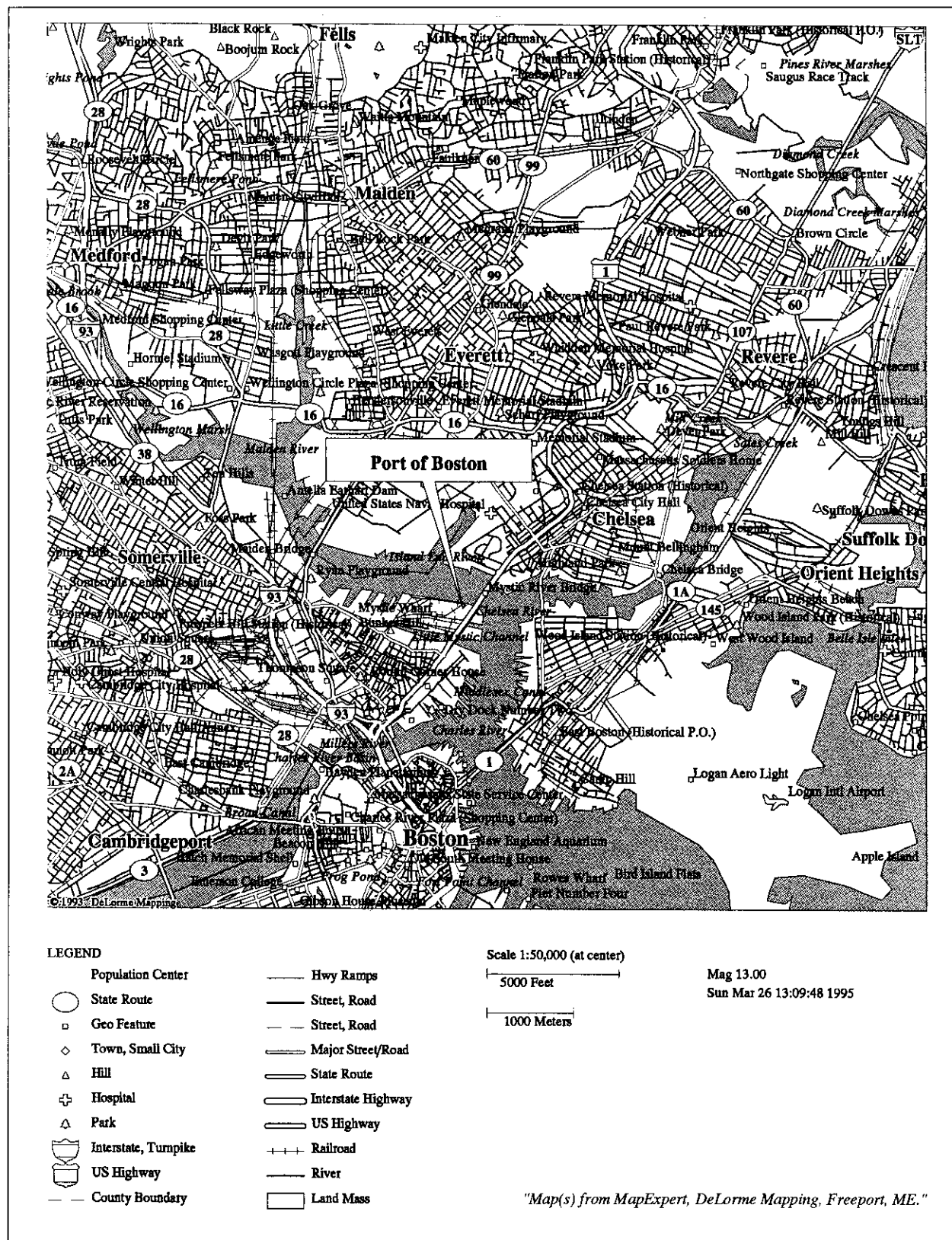


Figure D-33 Map of the Port of Boston, MA

The container terminal, Berth 11, has two 41 metric ton (45 ton) container cranes and an open storage area of 4 ha (9.9 acres). Berth 12 is presently undergoing a \$50 million improvement program (to be completed in 1995), and Berths 13-15 are leased to automobile importers. Berths 16 and 17 are served by one container crane (31 metric ton) and are also leased by automobile importers (Jane's, 1992; AAPA, 1993 and 1994; D&B, 1993; POB, 1993). The terminal is approximately 3.2 km (2 mi) from Route I-93, which is part of the Greater Boston Beltway, which then connects with I-95 and I-90 (the Massachusetts' Turnpike). Access to the terminal is via East and West Broadway, a busy South Boston thoroughfare running through an area of primarily small businesses with some old residential housing. Construction of the Third Harbor Tunnel/Seaport Access Road began in 1992 for better interstate access. The terminal is served by Conrail whose tracks are located outside and at the rear of the terminal.

Massport Marine Terminal: This is a 16 ha (40 acre) facility used for cruise ships and the discharge of automobiles (roll-on/roll-off) and bulk cargo. This terminal is about 1.6 km (1 mi) from I-93 via Northern Avenue (a truck route to the Boston Fish Pier) and other industrial users along the waterfront (Jane's, 1992; AAPA, 1993 and 1994; D&B, 1993; POB, 1993).

Other Pertinent Information: Massport has its own security force, which has police powers at State-owned terminals. Although there is no officially designated space for segregating hazardous materials, the port would provide one if necessary. There are no known regulatory restrictions against handling of spent nuclear fuel at Massport terminals; the Deputy Port Director for Operations did not know if the port has ever handled spent nuclear fuel (Moriconi, 1993).

Massport relies on its fire department, which also has a fireboat, for emergency response for hazardous materials accidents, and on Coast Guard supervision. The port also coordinates its activities with State hazardous materials safety personnel. Massport has a training program for terminal workers at Moran, and recently began an introductory course for longshoremen. Training at leased facilities, like Moran Terminal, is the responsibility of the terminal operator (Moriconi, 1993).

Moran Container is located in the densely populated Charlestown area on the Mystic River across from petroleum and natural gas terminals, and a residential condominium/marina complex. Conley Terminal is in an industrial area with less conflicting use, but access is through South Boston, also a densely populated commercial/residential area.

There are no known special environmentally sensitive areas within the port. The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Boston, the Uniform Building Code requires buildings to withstand wind speeds up to 140 km/hr (85 mph). The port is located in a moderate seismic zone with an acceleration of 0.30 g.

The 1990 population within 16 km (10 mi) of the port terminals was 1,466,233. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 1,080,000; Oak Ridge Reservation, 912,000; Idaho National Engineering Laboratory, 716,000; Hanford Site, 785,000; and Nevada Test Site, 796,000. Populations along rail routes to these sites are much larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,734 km (1,079 mi); Oak Ridge Reservation, 1,600 km (995 mi); Idaho National Engineering Laboratory, 4,180 km (2,600 mi); Hanford Site, 4,850 km (3,016 mi); and Nevada Test Site, 4,560 km (2,832 mi). Distances along rail routes are about the same for Hanford Site and Idaho National Engineering Laboratory, and are slightly longer for Savannah River Site, Oak Ridge Reservation, and Nevada Test Site.

Climatic Conditions

Three important influences are responsible for the main features of Boston's climate (DOC, 1993a). First, the latitude 42°N places the city in the zone of prevailing west to east atmospheric flow, which encompasses the northward and southward movements of large bodies of air from tropical and polar regions. This results in variety and changeability of the weather elements. Secondly, Boston is situated on or near several tracks frequently followed by systems of low air pressure. The consequent fluctuations from fair to cloudy or stormy conditions reinforce the influence of the first factor, while also ensuring a rather dependable precipitation supply. The third factor, Boston's east coast location, is a moderating factor affecting temperature extremes of winter and summer.

Hot summer afternoons are frequently relieved by the locally celebrated "sea-breeze," as airflows inland from the cool water surface to displace the warm westerly current. This refreshing east wind is more commonly experienced along the shore than in the interior of the city or the western suburbs. In winter, under appropriate conditions, the severity of cold waves is reduced by the nearness of the then relatively warm water. The average date of the last occurrence of freezing temperature in spring is April 8; the latest is May 3, 1874 and 1882. The average date of the first occurrence of freezing temperature in autumn is November 7; the earliest on record is October 5, 1881. In suburban areas, especially away from the coast, these dates are later in spring and earlier in autumn by up to one month in the more susceptible localities.

Boston has no dry season. For most years the longest run of days with no measurable precipitation does not extend much more than two weeks. This "dry spell" may occur at any time of year.

Much of the rainfall from June to September comes from showers and thunderstorms. During the rest of the year, low-pressure systems pass more or less regularly and produce precipitation on an average of roughly one day in three. Coastal storms, or "northeasters," are prolific producers of rain and snow. The main snow season extends from December through March. The average number of days with four inches or more of snowfall is four per season, and days with seven inches or more come about twice per season. Periods when the ground is bare or nearly bare of snow may occur at any time in the winter.

Relative humidity has been known to fall as low as five percent (May 10, 1962), but such desert dryness is very rare. Heavy fog occurs on an average of about two days per month, with its prevalence increasing eastward from the interior of Boston Bay to the open waters beyond. Winds from the east to southwest bring fog and westerly and northerly winds clear the fog away.

At all seasons the heaviest gales are usually from the northeastward or eastward. Although winds of 32 mph or higher may be expected on at least 1 day in every month of the year, gales are both more common and more severe in winter (DOC, 1993a).

D.2.2.3 Eddystone, PA

The location of Penn Terminals at Eddystone is on the former site of Pennsylvania Shipbuilding Company's North Yard Wharf, just upstream of the entrance to Ridley Creek in Eddystone, PA. It is located approximately 18 km (11 mi) south of Philadelphia. It is approximately 1.5 km (1 mi) above the small port of Chester, PA. Penn Terminals, Inc. is one of several independent Delaware River port terminal operators who come under the marketing umbrella of the Delaware River Port Authority (AAPA, 1994). A map of the port is shown in Figure D-34.

Geophysical and navigational data for Penn Terminals is, with the exception of the approach to the Terminal, the same as for Philadelphia and other Delaware River Ports in the immediate vicinity (AAPA, 1994).

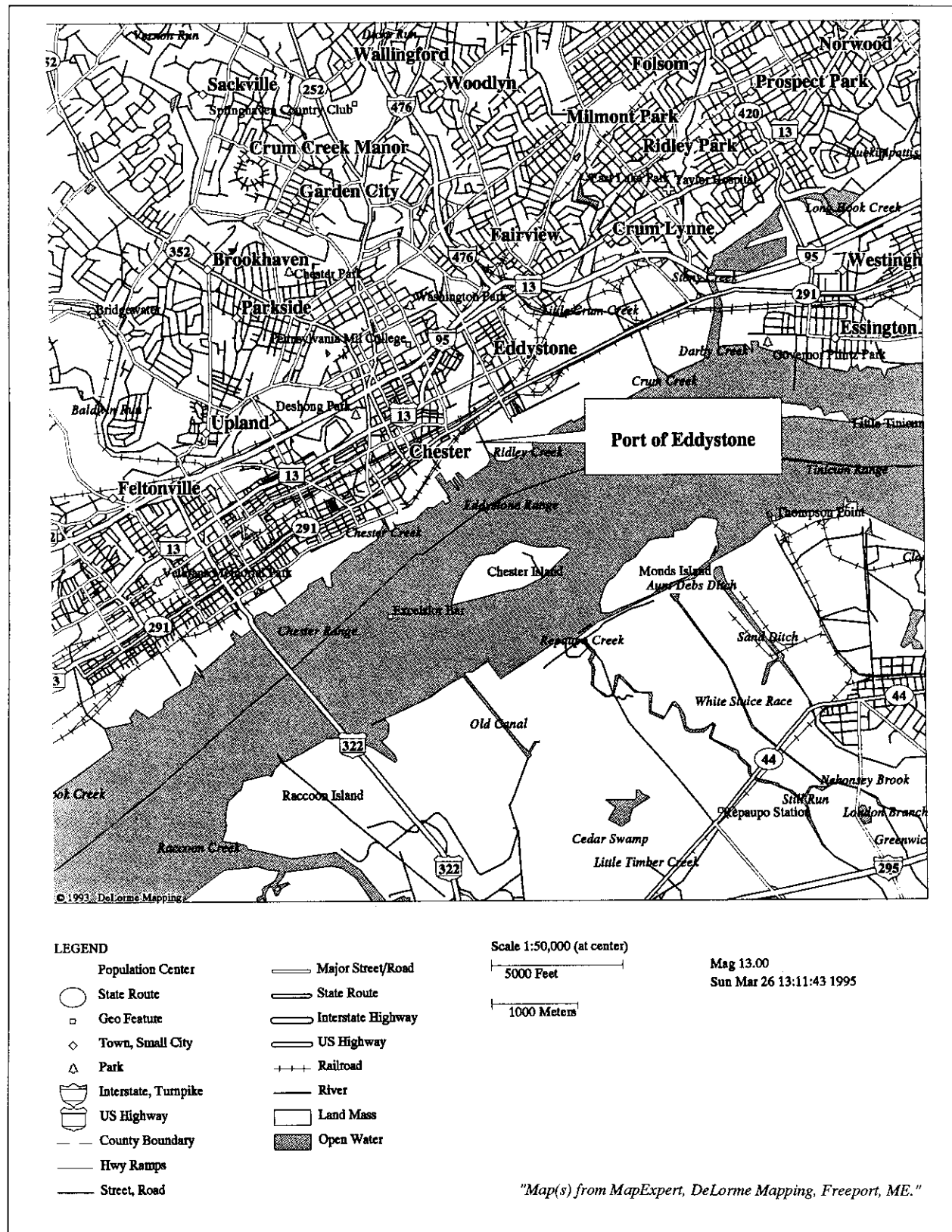


Figure D-34 Map of the Port of Eddystone, PA

Penn Terminals was founded in 1986 to manage containerized cargoes but subsequently expanded its scope of services to include breakbulk and project cargoes. Penn Terminals' brochure states that they handle about 250 ship calls a year (PT, 1994). A port official reported that the Terminal handles 30,000 to 50,000 20-ft equivalent units a year, including some hazardous and radioactive materials (Davis, 1994). According to the Sandia National Laboratory's Radioactive Materials Postnotification (RAMPOST) Database, on April 17, 1991, this port was used for receipt of about 1.4×10^{16} Bq [366,000 curies (Ci)] of cobalt-60 for shipment to Dickerson, MD, in a Type B cask comparable to those used for spent nuclear fuel shipments (SNL, 1994). There was no indication of foreign research reactor spent nuclear fuel receipts since October 1984, when the database was established.

The Terminal features 40.7 ha (71 acres) of storage area, including 23,200 m² (250,000 ft²) of covered storage. The terminal has 335 m (1,100 ft) of marginal wharf, container gantry cranes, a 27 metric ton (30 ton) and a 41 metric ton (45 ton) and a heavy lift truck crane with a capacity of 220 metric tons (240 tons). Rail service is provided by Conrail. Access to Interstate 95 is about 1.6 km (1.0 mi) from the terminal via industrial and old residential streets (PT, 1994; AAPA, 1994).

The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Eddystone, the Uniform Building Code requires buildings to withstand wind speeds up to 130 km/hr (80 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 609,241. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 400,000; Oak Ridge Reservation, 300,000; Idaho National Engineering Laboratory, 600,000; Hanford Site, 600,000; and Nevada Test Site, 700,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,170 km (725 mi); Oak Ridge Reservation, 1,060 km (660 mi); Idaho National Engineering Laboratory, 3,930 km (2,440 mi); Hanford Site, 4,590 km (2,850 mi); and Nevada Test Site, 4,180 km (2,600 mi). Distances along rail routes are about the same.

Environmental Conditions

Monds Island and Chester Island are directly across the shipping channel from the port, and Little Tinicum Island is 1.8 km (1.1 mi) upriver. Tidal flats surround these islands, which are comprised of marshes and wetlands. The Tinicum National Environmental Center, located approximately 3.5 km (2.2 mi) to the northeast on Darby Creek, is a nationally recognized wetlands and environmental education center.

The Port of Eddystone is located within Zone 4 (tidal river) of the Delaware River. Protected water uses for Zone 4, which encompasses River Miles (RM) 79-95, are water supply (industry), wildlife, resident fish maintenance, anadromous fish passage, secondary contact, and navigation (DRBC, 1994). However, several uses within Zone 4 are currently impacted, including: fish and other aquatic life due to low dissolved oxygen levels from point source discharges, and fish and shellfish consumption due to chlordane and PCB contamination from point and nonpoint source discharges.

The Delaware River at Eddystone is classified as a low salinity estuarine (generally 0.5 to 5 ppt) and tidal freshwater habitat. Aquatic organisms that are typically found in the waters of this area include: American shad, Atlantic sturgeon, American eel, blueback herring, shad, alewife, white catfish, brown bullhead, perch, striped bass, bluegill, crappie, pumpkinseed, largemouth bass, carp, and chain pickerel.

(FWS, 1980f). In addition, the Delaware River is used as a migratory area by the shortnose sturgeon, a Federally listed endangered species. The Water Quality Section of the Pennsylvania Department of Environmental Resources reported that 67 species of fish are full or part-time residents of this part of the Delaware estuary (Boyer, 1994). Most importantly, the area of the river between Monds Island, Chester Island, and Little Tinicum Island and the islands' backwaters, is an important spawning site for the striped bass.

This area of the Delaware River serves as a sport fishery for striped bass, American shad, blue-claw crabs, white perch, largemouth bass, and catfish. There is also limited commercial fishing for American eels and American shad. There is only low to medium recreational use of this part of the Delaware River due to the high volume of tanker and freighter traffic (Boyer, 1994).

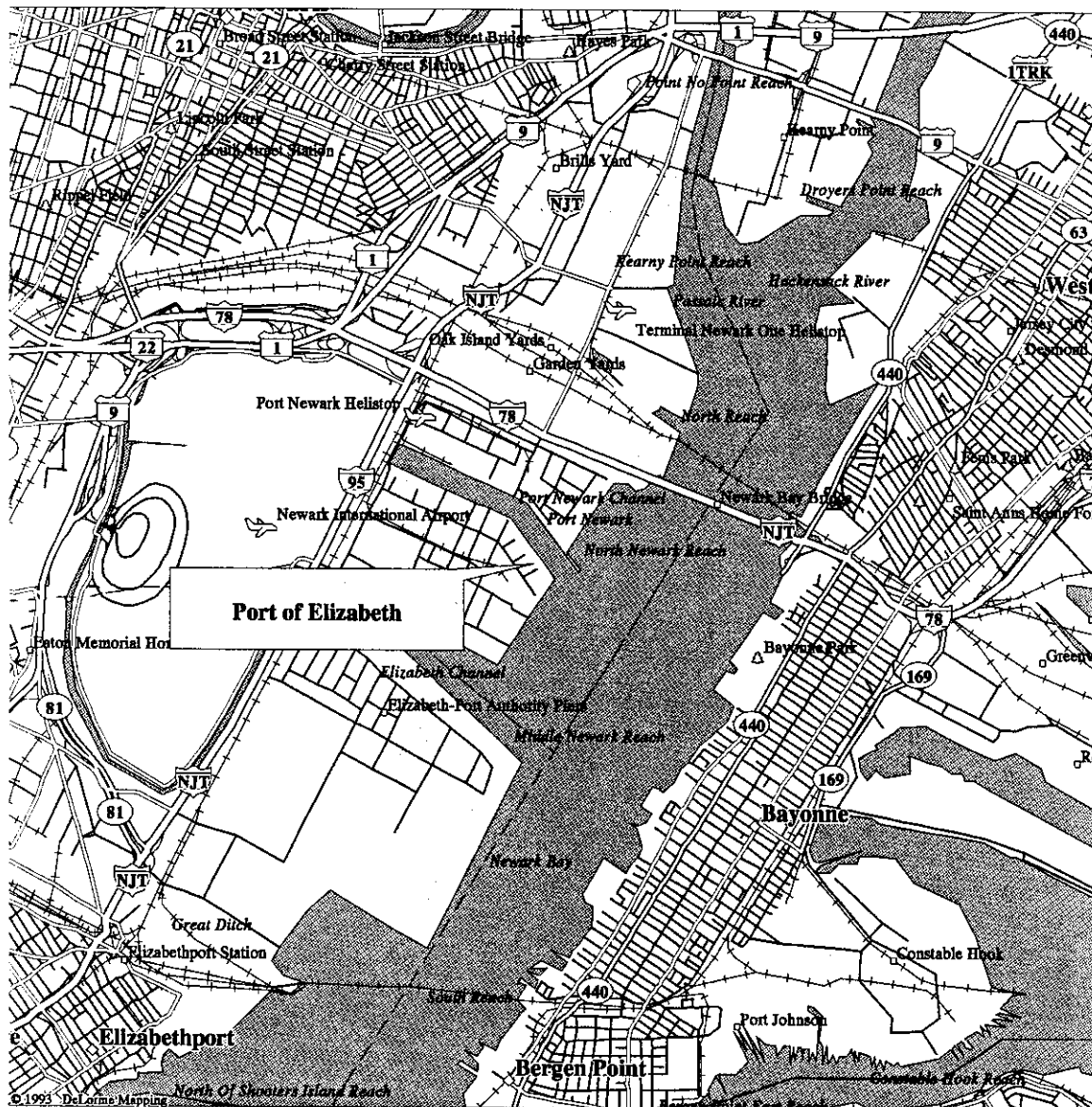
The U.S. Fish and Wildlife Service reported that except for occasional transient species, no Federally listed or proposed threatened or endangered species under their jurisdiction are known to exist in the port's impact area (Perry, 1994). Similarly, the Pennsylvania Natural Diversity Inventory reported that it did not expect any impact on rare, threatened, or endangered plant species in this location (PNDI, 1994).

Climatic Conditions

The climate of the Eddystone region is similar to that of Philadelphia, PA. The area is moderated by the Appalachian Mountains to the west and the Atlantic Ocean to the east. These geographic features cause periods of extreme temperatures to be short-lived in this region (generally, four days). On occasion during the summer months, the area is dominated by maritime tropical air masses, which contribute to elevated local temperature and humidity levels. The average annual precipitation of 105.2 cm (41.42 in) is relatively evenly distributed throughout the year, with maximum amounts occurring during the late summer months. The summer precipitation regime is dominated by localized thunderstorms and are subject to the influence of the urban heat island effect and local topography, which create varying rainfall amounts across the city for an individual event. Singular snowfall events that generate accumulated totals of greater than 25.4 cm (10 in) have a 5-year recurrence interval on average. The prevailing wind direction has a bimodal distribution, being southwesterly during summer and northwesterly in the winter months. The annualized average prevailing wind direction is from the west-southwest. Due to this region's inland location, destructive winds are comparatively rare from tropical cyclones and tornadoes. High winds are generally associated with frontal passages/low pressure systems and thunderstorms in the winter and summer months, respectively. However, flooding on the Schuylkill River normally occurs twice annually, usually associated with strong thunderstorms, with the duration of these events generally lasting less than 12 hrs. The Delaware River is rarely observed at or above flood stage (NOAA, 1992h).

D.2.2.4 Elizabeth, NJ

New York Harbor is the principal entrance by water to New York City and the surrounding ports. The harbor is divided by the Verrazano Narrows into the Lower Bay and Upper Bay. Using the Verrazano Narrows Bridge as a reference point, Port Elizabeth is approximately 18 km (11 mi) from the Lower Bay and the Atlantic Ocean via Kill Van Kull. The Battery, the southern tip of Manhattan, is at the junction of the East River and Hudson River. New York Harbor includes New York City, Staten Island, and the New Jersey principal ports of Perth Amboy, Port Elizabeth, Port Newark, and Bayonne. The project depth of the channels leading from the sea through the Lower Bay, Narrows and Upper Bay is 13.7 m (45 ft). Depths in the Kill Van Kull leading to the New Jersey container terminals is 10.7 m (35 ft). The approaches to New York Harbor are open, but highly trafficked. The 13 km (8 mi) down the Kill Van Kull to Port Elizabeth is restricted (DOC, 1993b). A map of the port is provided in Figure D-35.



"Map(s) from MapExpert, DeLorme Mapping, Freeport, ME."

Figure D-35 Map of the Port of Elizabeth, NJ

Unlike many ports of the world, no single governmental or public agency in New York is responsible for controlling the overall operation of the port. Port administration is divided among many organizations, both private and public, which have an institutional interest in port activities.

The Port Authority of New York and New Jersey (Port Authority) is a quasi-public agency established in 1921 by treaty between the states of New York and New Jersey to deal with the planning and development of terminal and transport facilities, and to improve and protect the commerce of the port district.

The Port Authority's main maritime facilities are located in Elizabeth, Port Newark, and Hoboken, New Jersey, and in New York, at Erie Basin and Columbia Street terminals in Brooklyn. The City of New York owns the South Brooklyn Marine Terminal, Red Hook Marine Terminal (also in Brooklyn), and Howland Hook Marine Terminal on Staten Island. The latter is a major container terminal now leased to the Port Authority. Global Terminal, a privately owned and operated container facility, is located in Jersey City. All told, there are five separate container areas within the harbor equipped with a total of 35 container cranes along a total quay length of 8,000 m (approximately 5 mi), and a total berth area of about 500 ha (1,236 acres) (Jane's, 1992; AAPA, 1993).

With the exception of Global Terminal, all of the foregoing terminals are leased from the Port Authority or the City of New York and operated by terminal operating companies or steamship lines. Since virtually any one of these terminals would be physically capable of handling containers of spent nuclear fuel, description of the port's capabilities is limited to a single terminal, the Port Authority Marine Terminal, within the Port Authority's Port Elizabeth/Port Newark container complex. The Port Elizabeth/Newark area has direct access to the New Jersey Turnpike and is farthest removed (relatively) from centers of population.

Sea-Land Terminal (Elizabeth NJ): Berths 88-98 on the southeast corner of Elizabeth Channel have 1,403 m (4,603 ft) of marginal wharf. The terminal has 12.2 m (40 ft) depth alongside at mean low water. Sea-Land has crane capacities of six 40.6 metric ton (44.8 ton) container gantry cranes. Truck access to the New Jersey Turnpike (I-95) is via Port Newark (Exit 14) or Exit 13A in Elizabeth. The latter is reached via McLester Street to State Route 81 to the Turnpike. The route is almost entirely within the Port Authority Marine Terminal complex and distance traveled is estimated to be about 4.8 to 6.4 km (3 to 4 mi), respectively. The Sea-Land Terminal is adjacent to the Conrail Portside and the Port Authority intermodal rail yards.

In addition to Sea-Land, the Terminal is used by Hanjin Shipping Lines, Ltd., Italia Line, Nedlloyd, P & O Containers, Samskip, S.C.I. Line, Spanish Line, and Transroll Navegacao, SA. The list of container lines calling at other terminals is extensive and represents the major container carriers of the world (Jane's, 1992; AAPA, 1993).

Other Pertinent Information: Individual Terminals are responsible for their own security arrangements. However, it is believed that the New York Port Association controls and may serve as watchmen. All terminals are fenced with controlled access and 24-hour surveillance. A port official did not know what type of short-term storage arrangements exist at the Sea-land Terminal; however, he believed there is provision for segregating hazardous cargoes. He also did not know if there are any restrictive ordinances pertaining to spent nuclear fuel or if the port has handled it (Hennessy, 1993). Available data indicates spent nuclear fuel shipments have not been handled at least since 1979 (NRC, 1993; SNL, 1994).

The Kill Van Kull waterway, serving Port Elizabeth/Newark terminals, is also the approach route to the refineries and petroleum storage depots located along the Arthur Kill to the south. There is a great diversity of traffic and cargoes in the harbor but, due to the layout of the terminals, this diversity and traffic are not considered a major concern.

The Coast Guard and fire departments from the cities of Elizabeth and Newark, respond to hazardous materials incidents within terminals located within their municipalities. The Union County hazardous materials team responds to accidents in Port Elizabeth, and the Newark hazardous materials team in Port Newark. Sea-Land and other terminal operators have contracts with private companies for oil and chemical spill cleanup and/or decontamination work. It is not known what type of hazardous materials training is provided by terminal operators and/or the Port Authority (Hennessy, 1993). Training normally is provided in such large port operations. This was not investigated further because the port was not included in the final list selected for detailed assessment due to the extremely large populations around the port.

The Port Elizabeth/Newark terminals are separated from the urban city centers bearing their names. However, both are adjacent to Newark Airport and areas of heavy industrialization and heavy traffic on the Turnpike. There are also areas of dense population on the east side of Newark Bay in the cities of Bayonne and Jersey City. The 1990 population within 16 km (10 mi) of the port terminals was 3,223,038. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 316,000; Oak Ridge Reservation, 290,000; Idaho National Engineering Laboratory, 536,000; Hanford Site, 585,000; and Nevada Test Site, 782,000. Populations along rail routes to these sites are much larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,320 km (828 mi); Oak Ridge Reservation, 1,190 km (738 mi); Idaho National Engineering Laboratory, 3,860 km (2,396 mi); Hanford Site, 4,520 km (2,812 mi); and Nevada Test Site, 4,300 km (2,672 mi). Distances along rail routes are slightly longer.

There are no known special environmental concerns in the greater New York/New Jersey port area. The likelihood of severe natural phenomena, such as high winds and earthquakes, are reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Elizabeth, the Uniform Building Code requires buildings to withstand wind speeds up to 140 km/hr (85 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

Climatic Conditions

New York Harbor is located on the Atlantic coastal plain at the mouth of the Hudson River. The terrain is flat and diversified by numerous waterways; all but one of the city's five boroughs are situated on islands. Elevations range from less than 15 m (50 ft) over most of Manhattan, Brooklyn, and Queens to almost 90 m (300 ft) in the northern part of Manhattan and the Bronx, and over 120 m (400 ft) in Richmond (Staten Island).

Despite its nearness to the ocean and the numerous bays and rivers nearby, the port has a climate which more closely resembles the continental type of climate than it does the maritime type. Its modified continental climate follows from the fact that weather conditions affecting the city usually approach from a westerly direction and not from the ocean on the east. Some important exceptions to this must be noted, since the oceanic influence is by no means entirely absent. During the summer, local "sea breezes," winds

blowing onshore from the cool water surface often moderate the afternoon heat; and most often in winter, coastal storms, accompanied by easterly winds, produce, on occasion, considerable amounts of precipitation.

From November through April the prevailing winds are from the northwest; for the remainder of the year the prevailing winds are southwesterly. Gales with velocities of 64 km/hr (40 mph) or more are predominantly from the northwest.

The mean annual temperature is slightly higher than that of most places in the United States of the same latitude, with the exception of localities near the Pacific coast. Precipitation is both moderate and distributed evenly throughout the year. Most of the rainfall from June through September comes from thunderstorms, therefore, is usually of brief duration, but relatively intense. From October to April, however, precipitation is generally associated with widespread storm areas, so that day-long rain or snow is common. Over the entire year, the city receives 59 percent of the sunshine hours possible at its latitude. This value compares favorably with that for any region east of the Mississippi, except the Southeast. Relative humidity averages about 66 percent for the year, showing that the city has a relatively damp climate.

Winds play an important role by affecting currents in the harbor. During the winter, west and northwest winds prevail, with northerlies and southwesterlies in secondary roles. The strongest winds are out of the west through northwest at 13 to 15 knots, from January through April. The sheltering effect of the land is apparent when looking at frequencies of winds of 28 knots or more. These winds blow at Ambrose Light about eight to nine percent of the time compared to one percent at Kennedy Airport and Floyd Bennet Field. Summer winds are often out of the south and southwest with a 10 to 12 knot afternoon peak. Fog in the harbor area is more closely related to land-type fogs. In winter, fog is common on clear, calm mornings and more frequent than at Ambrose Light. Southerlies can also bring winter fogs of the advection type. During the spring and early summer, the harbor and its approaches are susceptible to advection fog, riding in on east through south winds. A morning peak still exists in the harbor, while Ambrose Light exhibits an afternoon maximum (DOC, 1993b).

D.2.2.5 Fernandina Beach, FL

The Port of Fernandina is located about 9.3 km (5 mi) above the Entrance Seabuoy to the St. Marys River and Cumberland Sound. The entrance is bordered by two jetties on the approach to the cities of Fernandina Beach (located on Amelia Island) and St. Marys, GA, the Naval Submarine Base in Kings Bay, and an inland passage to St. Andrew sound via the Cumberland River (DOC, 1993d). The entrance is approximately 37 km (20 mi) north of the entrance to the Port of Jacksonville, which is located on the St. Johns River. A map of the port is shown in Figure D-36. Amelia Island is a small, historic, coastal resort town. Fort Clinch, a State Park, museum, and recreation area is located on the north end of Amelia Island at the inshore end of the south entrance jetty (DOC, 1993d).

The Port of Fernandina is a forest products and general cargo container port. It handles around 25,000 20-ft equivalent units of containerized freight and about 272,000 metric tons (299,000 tons) of forest products annually, but the container volume has varied considerably from year to year. Much of the port's trade is with South and Central America. There is also eastbound monthly service to the Mediterranean (Southern Shipper, 1993; American Shipper, 1994; Stubbs, 1994). Reportedly, the current controlling depth of the entrance, and that of approach channel to the submarine base, is 14.3 m (47 ft) and the controlling width is 122 m (400 ft). The same width channel with 10.3 m (34 ft) controlling depth is available to the Ocean Highway and Port Authority Terminal in Fernandina Beach. There is a 1.8 m (6 ft)

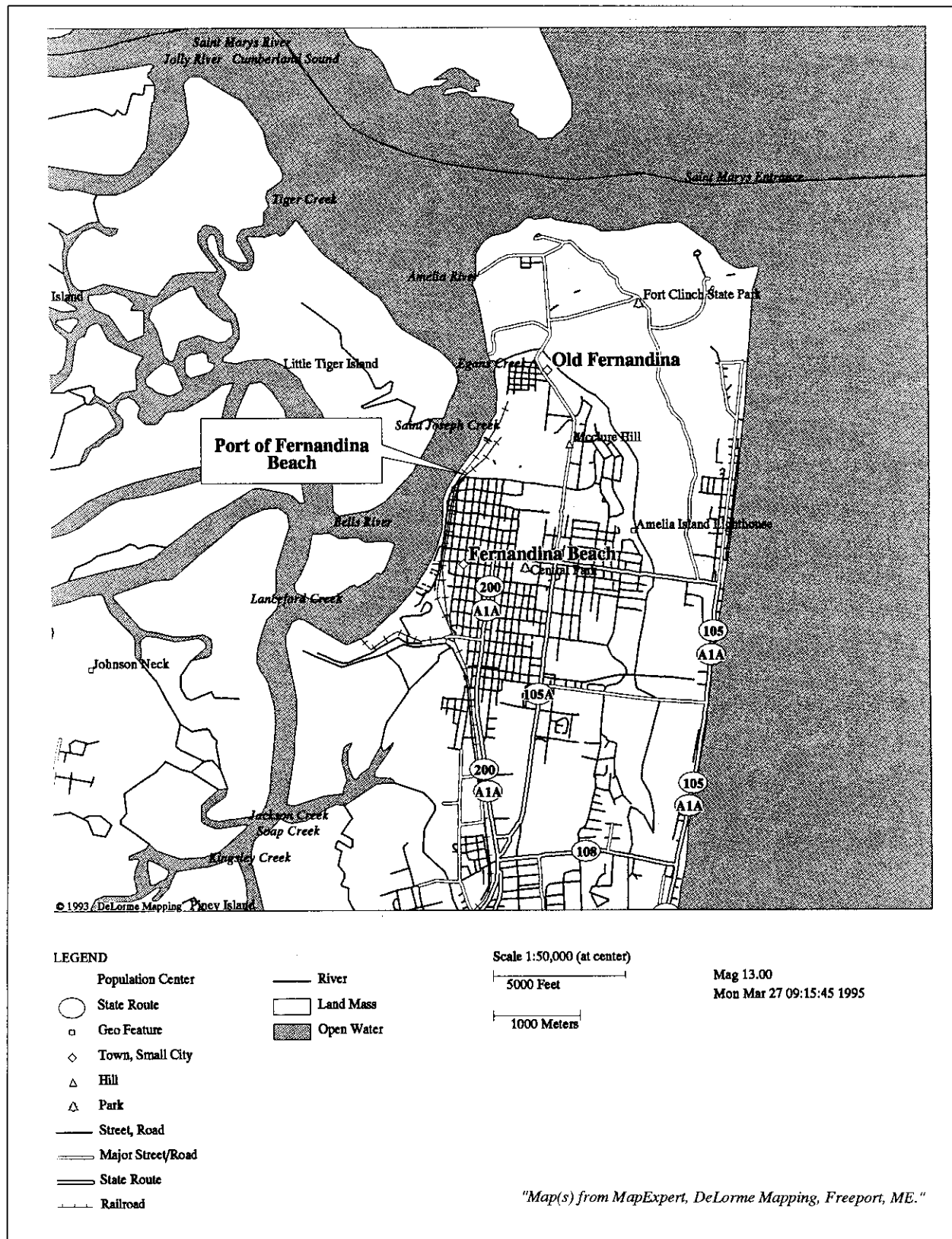


Figure D-36 Map of the Port of Fernandina Beach, FL

range of tide at Fernandina Beach. Tidal currents at the entrance have considerable velocity and are dangerous at times. A strong current "set" occurs at the St. Mary's entrance under certain weather conditions, it has been reported as high as 2.6 mi-per-sec (5 knots) (DOC, 1993d).

The Forest Products Terminal, located about 12 km (8 mi) above the channel entrance, is a publicly owned facility operated by Nassau Terminals, a private terminal operating and stevedoring company. Following a port expansion in 1992, the Terminal consists of 366 m (1,200 ft) of useable berthing situated on the left ascending bank of the Amelia River. The new capacity of the port is about 50,000 20-ft equivalent units per year. The Terminal is equipped with two 36 metric ton (40 ton) container cranes and other container handling equipment, a 4,645 m² (50,000 ft²) container freight station, 2.0 ha (5 acres) of open storage area, and is served by the CSX Railroad with pierside rail trackage (DOC, 1993d; Southern Shipper, 1993). The port handles an average of two vessels a day, typically a cruise vessel and a cargo vessel. The only products normally handled by the port are forest products for a paper mill located in the area, and containers loaded with food and paper products. The passenger or cruise ship business is small, using smaller vessels for cruises in the near islands and offshore (Robas, 1994).

The port terminal is located in the downtown section of the town of Fernandina Beach. Truck access to the port is through the downtown area and mixed residential/business structures for a distance of about 8 km (5 mi). Total distance to Interstate 95 is about 24 km (15 mi), much of which is divided multi-lane highway of mostly rural character.

Other Pertinent Port Information: Terminal property is fenced and lighted and has 24-hour watchman service. Rail openings into the port are not secured. The port has little experience in handling hazardous materials, in that hazardous materials are not normally shipped in or out of the port (Robas, 1994).

The U.S. Army Corps of Engineers was to award a contract in October 1994 for deepening the harbor channel to 11 m (36 ft) and constructing a 366 m (1,200 ft) turning basin. The approach channel to the Terminal passes through a State aquatic preserve for the manatee and other marine animals. Nassau Terminals occasionally handles some containerized hazardous materials; however, a port official thought there would be considerable local opposition to handling spent nuclear fuel shipments for fear of the effect of adverse publicity on tourism in this popular resort area (Stubbs, 1994).

The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Fernandina Beach, the Uniform Building Code requires buildings to withstand wind speeds up to 150 km/hr (95 mph). The port is located in a low seismic zone with an acceleration of 0.075 g or less.

The 1990 population within 16 km (10 mi) of the port terminals was 32,952. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 45,000; Oak Ridge Reservation, 185,000; Idaho National Engineering Laboratory, 590,000; Hanford Site, 650,000; and Nevada Test Site, 650,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 610 km (380 mi); Oak Ridge Reservation, 920 km (570 mi); Idaho National Engineering Laboratory, 4,000 km (2,500 mi); Hanford Site, 4,700 km (2,900 mi); and Nevada Test Site, 4,200 km (2,600 mi). Distances along rail routes are slightly longer for Western sites, and about the same for Eastern sites.

Environmental Conditions

The State of Florida has classified the Amelia River near the St. Mary's Entrance as a Class III water body. This classification indicates that the waters are suitable for recreation, and propagation and maintenance of a healthy, well balanced population of fish and wildlife (FL DEP, 1994). In addition, the State of Florida has designated certain waters in the vicinity of Fernandina Beach as "Outstanding Florida Waterways", which are afforded special protection. Outstanding Florida Waters are generally waters located within national parks, state parks, national seashores, marine sanctuaries, or aquatic preserves. Waters located near the Port of Fernandina Beach designated as Outstanding Florida Waters include Fort Clinch State Park, Fort Clinch State Park Aquatic Preserve, Nassau Valley State Reserve, and the Nassau River-St. Johns River Marshes Aquatic Preserve (FL DEP, 1994).

The Amelia River, in the vicinity of the Port of Fernandina Beach, is characterized as a mid- salinity estuarine habitat (generally 5 to 16.5 parts per thousand). There are both commercial and recreational fish and invertebrates found in the vicinity of the port. These aquatic species include: blue crabs, shrimp, American eel, Atlantic menhaden, tarpon, sea catfish, sheepshead, spotted seatrout, weakfish, spot, Atlantic croaker, kingfish, drum, flounder, silver perch, bluefish, mullet, pinfish, pigfish, ladyfish, and snapper (FWS, 1980e).

The Fort Clinch State Park and Fort Clinch State Park Aquatic Preserve are located on Amelia Island adjacent to Fernandina Beach. Birds that can be found in Fort Clinch State Park include various types of shorebirds, wading birds, waterfowl, raptors, songbirds, and seabirds. Endangered or threatened bird species in Fort Clinch State Park include: brown and white pelican, great egret, snowy egret, tricolored heron, little blue heron, black-crowned night heron, yellow-crowned night heron, least bittern, wood stork, white ibis, bald eagle, northern harrier, osprey, American kestrel, merlin, peregrine falcon, clapper rail, piping plover, American oystercatcher, least tern, black skimmer, royal tern, caspian tern, sandwich tern, worm-eating warbler, yellow-throated warbler, prairie warbler, Louisiana waterthrush, and American redstart (Fort Clinch State Park, 1994). Species with special status found in the area include the loggerhead sea turtle, the manatee, the American alligator, the least tern, and the burrowing four-o'clock (Murray, 1994). The loggerhead sea turtle, a Federally protected species, uses much of Amelia Island and Cumberland Island as nesting areas. In addition, the U.S. Fish and Wildlife Service reports that the following protected marine species may occur in Nassau County: west indian manatee (endangered), Kemp's ridley sea turtle (endangered), leatherback sea turtle (endangered), loggerhead sea turtle (threatened), hawksbill sea turtle (endangered), and the green sea turtle (threatened). Protected bird species include the wood stork (endangered) and red-cockaded woodpecker (endangered) (Bentzien, 1994).

Climatic Conditions

As with the other more northern ports, the climate of this area is also modified by the influence of the Atlantic Ocean. Easterly winds occur roughly 40 percent of the time, producing a true maritime climate for the area. The greatest rainfall occurs during summer, usually associated with afternoon and evening thunderstorms. During summer, measurable precipitation can be recorded nearly every two days. The prevailing winds are northeasterly in the fall and winter months and become more southwesterly during spring and summer. Although this region is located along the eastern Florida coast, it has been very fortunate in escaping hurricane-force winds. The majority of systems in recent years that have reached this latitude have moved parallel to the coastline, keeping well offshore. Others have weakened significantly moving over land prior to reaching the area. The combination of these two factors has spared the area from any major devastation due to tropical systems in recent years (NOAA, 1992e).

D.2.2.6 Freeport, TX

Freeport harbor is located about 64 km (40 mi) southwest of the Galveston, Texas harbor entrance, and about 5 km (3 mi) from the Gulf of Mexico on the Brazos River (DOC, 1992a), with the Gulf Intracoastal Canal crossing the river, making deepwater activity available. The main channel is maintained at 13.6 m (45 ft) and leads to a 364 m (1,200 ft) turning basin (D&B, 1993). Freeport is principally involved in petroleum and petrochemical transport (AAPA, 1994). However, in 1992, 188,400 metric tons (207,711 tons) of containerized cargo (approximately 20,000 20-ft equivalent units) were handled in the port. Primary inbound cargoes were bananas and fruit, and primary outbound cargoes were rice and chemicals (AAPA, 1994).

The harbor is regulated by the Navigation and Canal Commissioners of the Brazos River Harbor Navigation District, and is known locally as Brazosport (DOC, 1992a). The ship channel has been improved by construction of jetties on either side of the entrance. A map of the port is shown in Figure D-37.

Berth assignments at the Port of Freeport are made by the Terminal Superintendent. The port has five general breakbulk berths, 664 m (2,190 ft) in length with 10.9 m (36 ft) depth alongside. There is 19 ha (47 acres) of open storage adjacent to the wharves (D&B, 1993). The port has rail facilities with dual tracks on Berths 1, 1A (Brazos Harbor Public Facility Wharf), and 2 (Brazos River Harbor Wharf No. 2). Both facilities have substantial covered storage available for short-term storage. General cargo is usually handled by the ship's tackle, and no container cranes are available at the port [a floating 450 metric ton (500-ton) derrick is available for heavy lifts by special arrangement] (DOC, 1992a; AAPA, 1994).

Highway connection from the port is via State Highways 227 and 288, for approximately 56 km (35 mi) to Houston, where Interstate-10 is accessed.

Other Pertinent Information: There are no known restrictions on receipt of foreign research reactor spent nuclear fuel at the port, but there are substantial conflicting activities at the port, including petrochemicals and hazardous chemicals (AAPA, 1994). The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Freeport, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (100 mph). The port is located in a very low seismic zone with an acceleration of less than 0.075 g.

The 1990 census population of Freeport was 12,600. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 360,000; Oak Ridge Reservation, 300,000; Idaho National Engineering Laboratory, 480,000; Hanford Site, 530,000; and Nevada Test Site, 530,000. Populations along rail routes to these sites are slightly higher for Savannah River Site and Oak Ridge Reservation, but slightly lower for Idaho National Engineering Laboratory, Hanford Site, and Nevada Test Site. The approximate distances to the five potential sites on interstate routes are: Savannah River Site, 1,600 km (1,000 mi); Oak Ridge Reservation, 1,600 km (1,000 mi); Idaho National Engineering Laboratory, 3,100 km (1,900 mi); Hanford Site, 3,700 km (2,300 mi); and Nevada Test Site, 3,100 km (1,900 mi). Distances along rail routes are about the same.

Climatic Conditions

Weather in this area is only an occasional navigational problem. Winds blow at 28 knots (32 mph) or more approximately 3 to 4 percent of the time in November and from January through April. Average speeds are 12 to 14 knots (14 to 16 mph) during this period. Fog is also a winter problem, and visibilities drop below 160 m (0.25 mi) on approximately three to six days each month from November through April.

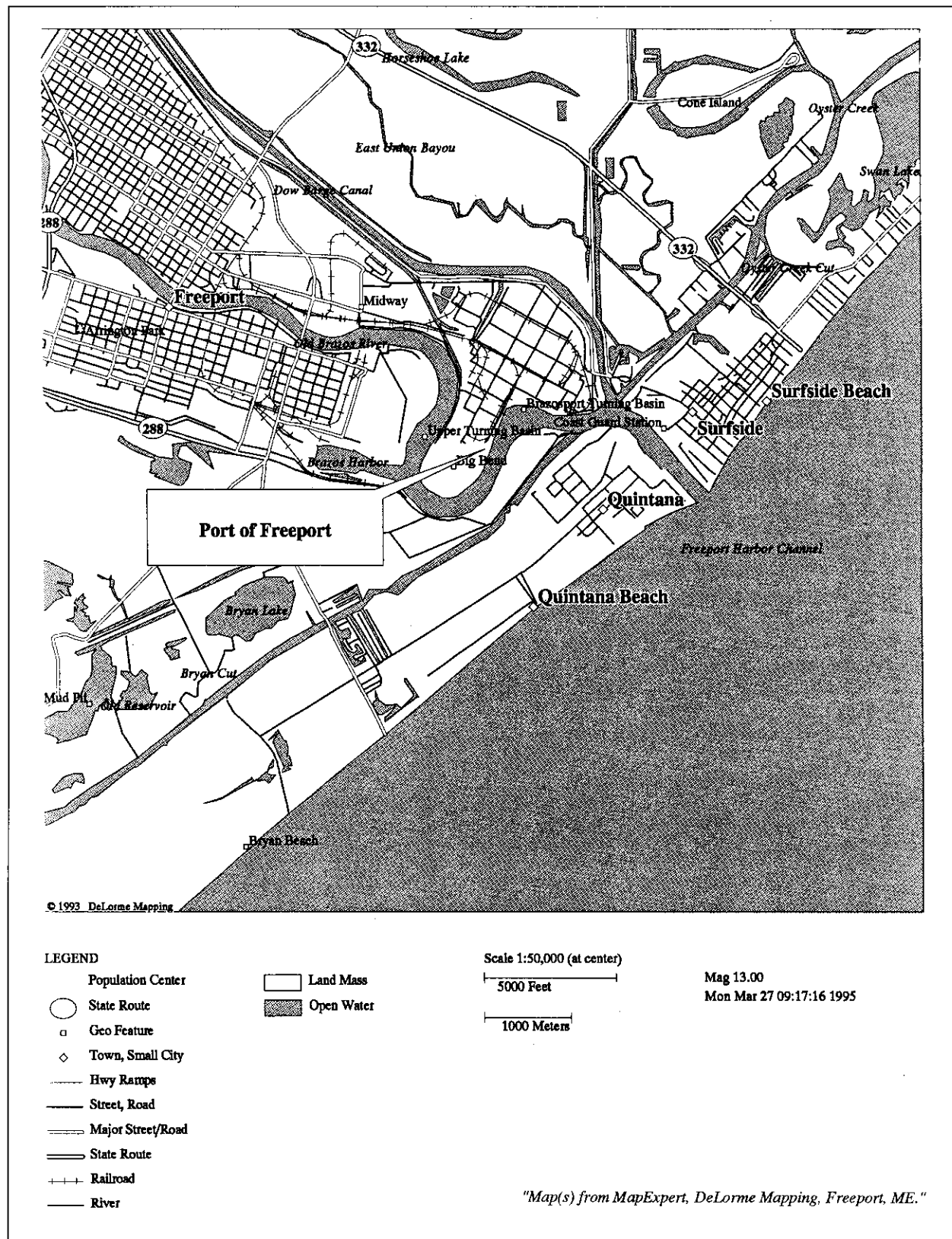


Figure D-37 Map of the Port of Freeport, TX

Thunderstorms are most frequent from April through September, during the afternoon and evening. These thunderstorms are usually air mass types as opposed to the less frequent but more severe thunderstorms that occur with fronts and squall lines from fall through spring. Tropical cyclones, particularly severe hurricanes, are most likely in August and September (DOC, 1992a).

D.2.2.7 Gulfport, MS

Gulfport, the seat of Harrison County, MS, is a seaport and tourist center located on the north side of Mississippi Sound, approximately 26 km (16 mi) from the entrance to the Ship Island Bar Channel on the Gulf of Mexico. Gulfport is located approximately 97 km (60 mi) east of New Orleans, LA. The approach to Gulfport is through a dredged channel marked by lighted buoys. Federal project depths are 9.7 m (32 ft) for the bar channel and 9.1 m (30 ft) for the Gulfport Channel and Harbor Basin. The harbor was deepened to 10.97 m (36 ft) mean low water in 1993 (DOC, 1992a; AAPA, 1993; Southern Shipper, 1993). A map of the port is shown in Figure D-38.

The State-owned Port of Gulfport is a small, but growing, niche port on the Gulf Coast primarily handling containerized banana imports and dry bulk commodities. The port has a growing general cargo outbound container tonnage as the fruit carriers fill otherwise empty containers on the return leg of voyages. Container traffic for fiscal year 1991 included 68,000 20-ft equivalent units amounting to approximately 664,973 mt (733,000 ton) of cargo (AAPA, 1993). By 1993, container volume increased to 736,100 mt (811,559 tons), or approximately 75,000 20-ft equivalent units (AAPA, 1994).

Gulfport has 10 berths with a total of 1,768 m (5,800 ft) of lineal berthing space. There is an open storage area of four ha (10 acres) and a shed area of 19,000 m² (204,500 ft²). A second container berth (East Pier) is used for self-contained container ships. The port's West Pier container berth is approximately 750 m (2,460 ft) long, whereas the East Pier is approximately 200 m (656 ft) long. Gulfport has two 30.5 metric ton (34 ton) container cranes at its West Pier (AAPA, 1994).

The port is located immediately adjacent to the City of Gulfport, which forms the northern boundary of the terminal area. The Terminal has almost immediate access to U.S. Highway 90, and is about 5 mi from I-10, a major east-west roadway. U.S. Highway 49, which begins at the terminal gate and connects with I-10, runs through the center of the City. The port is served by the CSX and Mid-South Railroads with connections to the Norfolk Southern at Hattiesburg. Double trackage extends to the container berth.

Gulfport is presently served by one common carrier combination container/breakbulk ship operator, ABC Line, which operates five large ships on North European around-the-world trade routes. Three other containerized fruit carriers also regularly call at Gulfport (AAPA, 1994; Southern Shippers, 1993).

Other Pertinent Information: Gulfport employs a port security firm that maintains 24-hour guard service. The port is fenced with controlled access to vehicles and personnel. It does not appear that there are any regulations preventing the importation of spent nuclear fuel, although the port indicates that the Coast Guard may impose bans on especially hazardous shipments (Edwards and Burns, 1993). Gulfport has no prior experience handling spent nuclear fuel (NRC, 1993; SNL, 1994) and, as far as is known, there are no hazardous cargoes routinely handled at Gulfport. Port personnel provide First Response augmented by the Gulfport Fire and Police Departments. The Port of Gulfport conducts hazardous materials training of port personnel (Edwards and Burns, 1993). There is a former small cruise ship terminal at the East Pier as well as a floating casino located near the street entrance to the port. The United States Coast Guard indicated that the East Dock is presently slated for casino development, and there are two casinos on the north end of

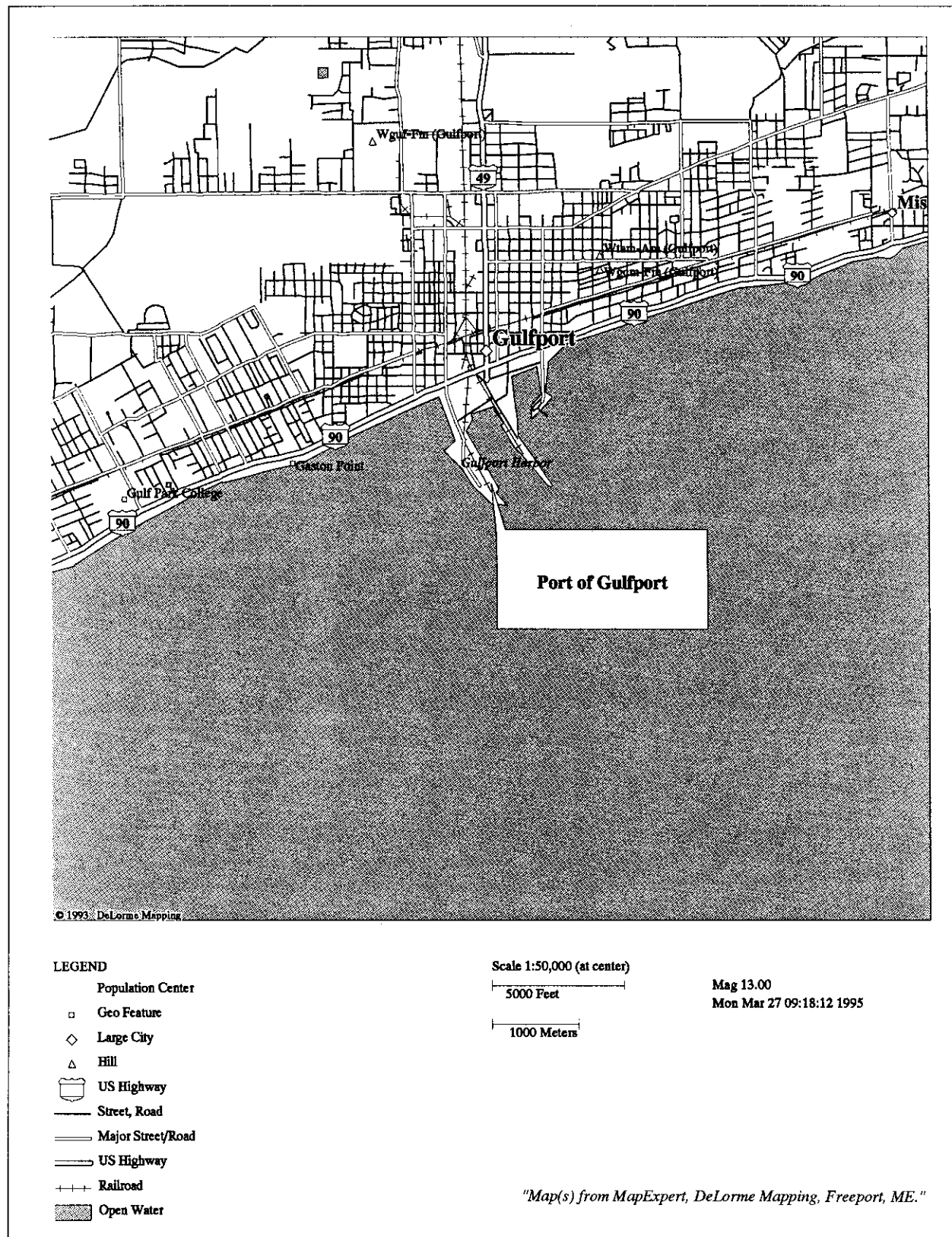


Figure D-38 Map of the Port of Gulfport, MS

the West Dock. As a result, the hazardous materials area at the north end of the West Dock has been eliminated for explosives. Also, the facility of particular hazard cannot be used for foreign research reactor spent nuclear fuel, and is not secure or well lit. (Brown, 1995)

There are no known sanctuaries or wildlife habitats in the immediate port area. However, to enter Gulfport, ships must pass close to the protected Gulf Islands National Seashore. The port is subject to severe hurricane and tropical storms. The likelihood of severe natural phenomena, such as high winds and earthquakes, are reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Gulfport, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a very low seismic zone with an acceleration of 0.075 g or less.

The 1990 population within 16 km (10 mi) of the port terminals was 113,153. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 194,000; Oak Ridge Reservation, 146,000; Idaho National Engineering Laboratory, 435,000; Hanford Site, 484,000; and Nevada Test Site, 683,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 910 km (565 mi); Oak Ridge Reservation, 920 km (573 mi); Idaho National Engineering Laboratory, 3,570 km (2,219 mi); Hanford Site, 4,240 km (2,635 mi); and Nevada Test Site, 3,530 km (2,195 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The Mississippi Sound is separated from the Gulf of Mexico by a series of uninhabited barrier islands. Vessels approaching the port from the Gulf enter the Ship Island Channel, which runs between the west end of Ship Island and Cat Island and the east end of Cat Island. Ship Island, along with Horn Island and Petit Bois Island, which are further to the east, comprise the Gulf Islands National Seashore. These islands serve as a wintering and migratory area for the protected Peregrine Falcon as well as various shorebirds. Ships entering the Ship Island Channel from the Gulf pass directly north of the northern end of the Chandeleur Islands that comprise the Breton National Wildlife Refuge and Breton Wilderness. The Breton National Wildlife Refuge and Breton Wilderness, which includes areas of black mangroves, serves as a breeding area for the protected loggerhead sea turtle and brown pelican, and a migratory area for the protected peregrine falcon. This area is also home to a variety of shorebirds, wading birds, waterfowl, raptors, seabirds, and songbirds (FWS, 1982a).

The U.S. Fish and Wildlife Service reported that several Federally-listed protected species may occur in the Port of Gulfport area. These species include the endangered brown pelican and Kemp's ridley sea turtle and the threatened gulf sturgeon and loggerhead sea turtle (Goldman, 1994). According to the Mississippi Natural Heritage Program, four protected species of bird have been spotted feeding or loafing in the area of the Port of Gulfport. These species include the royal tern, black rail, reddish egret, and the piping plover (Gordon, 1994). Commercial harvesting areas for the eastern oyster are located throughout the Mississippi Sound, including several areas within a few miles of the port. Breeding areas for the State-protected Least tern also are located along the coast of Gulfport (FWS, 1982a).

The waters in the vicinity of the port have been classified by the State of Mississippi for "recreation" but not as a water supply (Reaves, 1994). The nearshore waters of the Mississippi Sound are characteristic of a middle salinity estuarine habitat (generally 5 to 20 parts per thousand). Aquatic organisms that are

typically found in the waters of this area include: shrimp, blue crab, seatrout, croaker, drum, spot, kingfish, flounder, catfish, mullet, Florida pompano, bluefish, Gulf menhaden, bay anchovy, Crevalle jack, blue runner, Alabama shad, and Atlantic bottlenose dolphin (FWS, 1982a).

Climatic Conditions

Because of Gulfport's geographic location, the local weather is greatly influenced by the Gulf of Mexico. Generally, summers are warm but temperatures are more moderate than those observed at inland locations because of the diurnal sea breeze circulation. Winter weather is generally mild, with the exception of the occasional cold air outbreak. These events occur at 3-10 day intervals between October and April in the Gulf of Mexico region, generally lasting less than three days. The annual rainfall in this region is among the highest in the continental United States. The precipitation is fairly evenly distributed throughout the year with a maximum coinciding with the summer thunderstorm season and minimum occurring during the late Fall months. However, extended rainy periods are rare in this region. Thunderstorm frequencies are highest in July and August, where they may occur every other day, but rarely do they reach intense or violent levels. However, the area is quite vulnerable to tropical systems (e.g., Hurricane Camille, 1969), which originate in the West Indies, West Caribbean, and the Gulf of Mexico (NOAA, 1992i; Wayland and Raman, 1989).

D.2.2.8 Houston, TX

Houston is the largest city in the State of Texas, and the Port of Houston is one of the largest ports in the United States (in terms of total tonnage handled). Morgans Point, approximately 37 km (23 mi) from the entrance to Galveston Bay, marks the beginning of an extensive industrial area lining the Houston Ship Channel. Houston is at the head of the channel, 71 km (44 mi) from the Gulf of Mexico. The transit of large ships is restricted to the ship channel across Galveston Bay and through parts of the San Jacinto and Buffalo Bayou. A Federal project provides for a 12.2 m (40 ft) channel from the entrance to the Gulf of Mexico to Houston (Brady Island) DOC, 1992a). The Houston Ship Channel is 12.2 m (40 ft) deep, and its width ranges from about 76 m to 120 m (250 to 400 ft), making the transit difficult for the large number of ship transits each year (D&B, 1993). A map of the port is shown in Figure D-39.

The Port of Houston is a 40.2 km-(25 mi)-long complex of diversified public and private facilities located on both banks of the Houston Ship Canal, which empties into and transits Galveston Bay. Bulk cargoes, dry and liquid, (including petroleum and petrochemicals) comprise the major share of tonnage handled by the port. Estimated tonnage for 1992 amounted to a total of 114.3 million metric tons (126 million short tons), of which bulk accounted for 72 percent, breakbulk 6.6 percent, and container 3.4 percent.

The Houston Port Authority owns and operates six public cargo facilities including: the Turning Basin Terminal (general cargo) located at the head of the Houston Ship Channel; Jacintoport Terminal (general cargo) located on the north side of the channel near Channelview, Texas; and Barbours Cut Container Terminal located at the head of Galveston Bay on the left ascending bank of the Houston Ship Channel (Jane's, 1992; AAPA, 1993; POHA, 1993).

Barbours Cut Container Terminal: About 40 km (25 mi) from the entrance to the ship channel, this terminal is designed to handle containers, roll-on/roll-off ships. The Barbours Cut Container Terminal is equipped with eight container cranes and five container berths [each is 305 m (1,000 ft) long], plus a separate roll-on/roll-off terminal. The terminal occupies 87 ha (215 acres) of developed land, including 17.8 ha (44 acres) of paved marshalling area for roll-on/roll-off cargoes. Barbours Cut Container Terminal

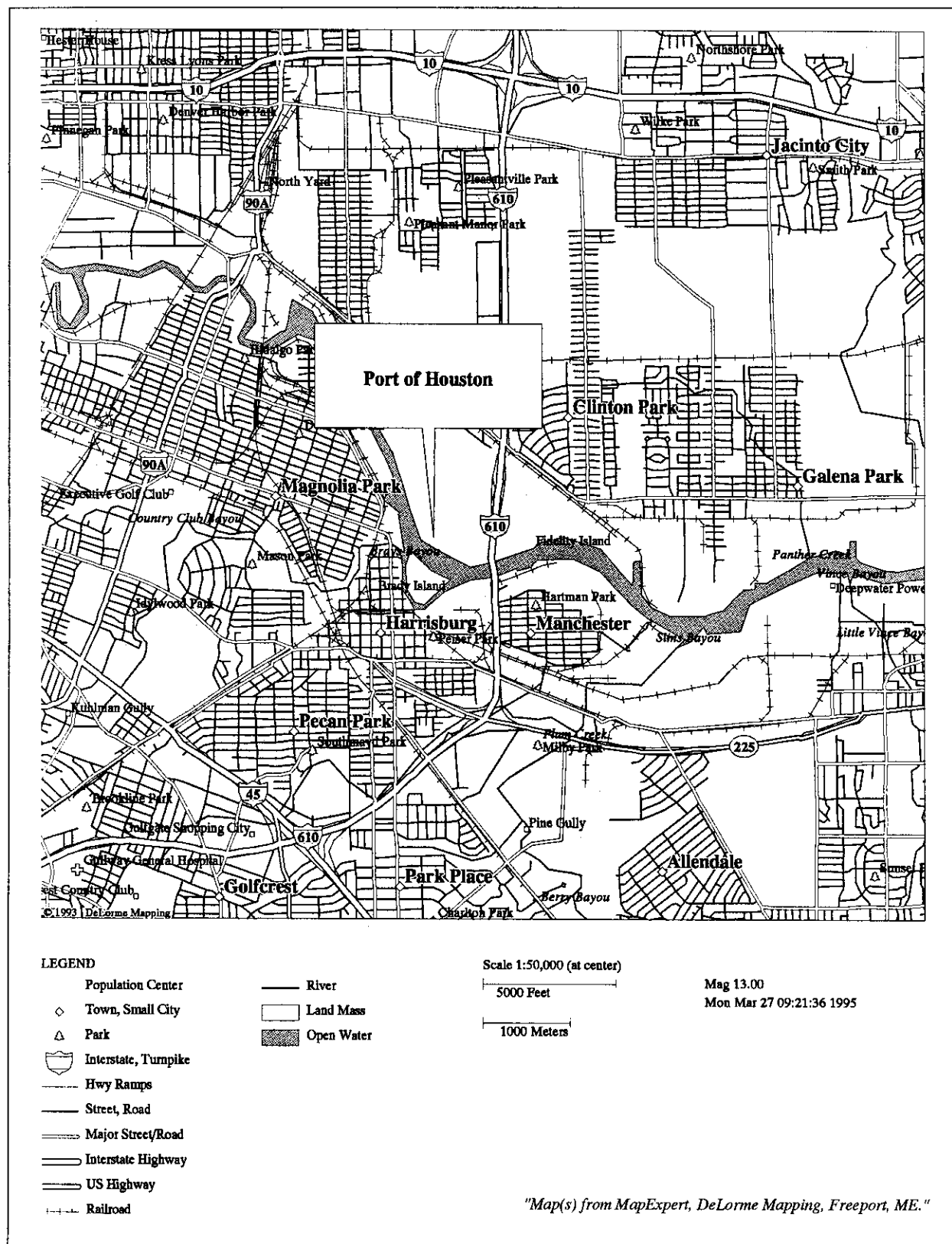


Figure D-39 Map of the Port of Houston, TX

has depths of 12.2 m (40 ft) at mean low water. Crane capacity for Barbours Cut Container Terminal is six 40.6 metric ton (45 ton) container cranes and two 30.5 metric ton (34 ton) container cranes (Jane's, 1992; AAPA, 1993).

Turning Basin Terminal: This terminal has several berths, the largest of which is 243.8 m (800 ft) long and can handle a 228.6 m (750 ft) ship. Turning Basin Terminal's depths are 10.97 m (36 ft) at mean low water. Crane capacity for this terminal is one 40.6 metric ton (45 ton) container crane and one 76.2 metric ton stiff-leg crane.

Barbours Cut Container Terminal has three entry points (gates) with a total of 21 truck lanes that are reached via Barbours Cut Boulevard, a multi-lane limited access roadway. Access to I-610, the Houston Beltway, and other interstate highways is via State Highway 146, which connects with State Highway 225 about 4.8 km (3 mi) from the Terminal. The Route 225 connector is an east-west highway about 22.5 km (14 mi) long. It appears that these routes run through commercial/residential areas with the opportunity for congestion. Barbours Cut Container Terminal is served by the Port Terminal Railroad Association and the Santa Fe Railroad. The Railroad Association connects with all other railroads including the Southern Pacific, Union Pacific, Burlington Northern, and the Houston Belt and Terminal Railroad. Trailer-on-Flat-Car shipments are possible within the terminal, but trackage does not extend to the container berths (Jane's, 1992; AAPA, 1993).

Barbours Cut Container Terminal is host to a large number of major international container and roll-on/roll-off ship lines. A partial listing includes: ABC Container Line, A. Bottacchi, ACL/Gulf Container Line, Afram Lines Ltd, America/Africa/ Europe Line, Atlantic Cargo Services, Baltic Shipping Co., Bank Line, Barber Blue Sea, CGM, CNAN, Columbus Line, COSCO, Costa Container Service, DB Turkish Cargo Line, Djakarta Lloyd, East Asiatic Ltd, Ellerman Line, Farrell Lines, Gulf Mideast Lines, Hapag-Lloyd, Hoegh Lines, Hyundai Merchant Marine, Italian Line, Ivaran Lines, Jugolinija, Kingwood Container Line, Maersk Line, Mediterranean Shipping Company, Nedlloyd Lines, SafBank Line, Sea-Land, Shipping Corp of India, Delmas-Vieljeux, Spanish Line, Torm Lines, Trans Freight Lines, United Arab Shipping Co., Waterman-Isthmian Line, and Zim Line (Jane's, 1992, AAPA, 1993).

Other Pertinent Information: The Houston Port Authority has its own 24-hour security force and all of its terminals are fenced with controlled access. A fireboat is stationed at Barbours Cut Container Terminal, which also has a full-service fire department. There is space within Barbours Cut Container Terminal for temporary segregation of hazardous cargoes (Horan, 1993).

A Port Authority Official was unaware of any regulations prohibiting the importation of spent nuclear fuel. The Houston Port Authority handles a lot of hazardous cargoes including radioactive substances, but the official did not know if the port has ever handled spent nuclear fuel (Horan, 1993). Available data indicates the port has not handled spent nuclear fuel at least since 1979 (NRC, 1993; SNL, 1994). The Houston Ship Channel and Galveston Bay are host to many petroleum and petrochemical berths and terminals served by a large amount of tanker and tank barge traffic. Many of these facilities are located upstream of Barbours Cut Container Terminal, which does not appear to have any conflicting use within its boundaries. The Houston Port Authority has its own emergency response team and fire department. The Houston Fire Department's hazardous materials team is used as a backup in emergencies. The Houston Port Authority has a hazardous materials training program for its terminal operating personnel. It is not known if longshoremen also receive this training (Horan, 1993).

There have been a number of ship accidents, tanker fires, and pipeline accidents at facilities near the Port of Houston in recent years. The United States Coast Guard data indicates that for the period 1991 to 1993, there were about 7,100 ship transits of the channel that resulted in 32 collisions, 33 allisions, 5 ship fires,

and 59 hard groundings (USCG, 1994b). Because the accident statistics also reflect barge traffic risks, the accident rate for oceangoing vessels is probably lower, but there is not data to refine that estimate available yet.

The Turning Basin Terminal is located at the terminus of the Ship Channel in a densely populated area above all other public and private terminal facilities within the port. Barbours Cut Container Terminal is remotely located from the City of Houston with relatively good separation from other terminals and traffic in the area (see II.E above). However, the two small communities of Morgan Point and La Porte (with a population of about 20,000) are located adjacent to the Terminal on the south.

There are no special plant, fish, or wildlife sanctuaries in the vicinity of Barbours Cut Container Terminal. The port is subject to hurricanes and tropical storms. The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Houston, the Uniform Building Code requires buildings to withstand wind speeds up to 150 km/hr (95 mph). The port is located in a very low seismic zone with an acceleration of less than 0.075 g.

The 1990 census city population was 1,630,553, with the density estimated at 1,083 persons/km². The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 349,000; Oak Ridge Reservation, 283,000; Idaho National Engineering Laboratory, 471,000; Hanford Site, 579,000; and Nevada Test Site, 524,000. Populations along rail routes to these sites are slightly smaller for Idaho National Engineering Laboratory, Hanford Site and Nevada Test Site, but slightly larger for Savannah River Site and Oak Ridge Reservation. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,550 km (964 mi); Oak Ridge Reservation, 1,480 km (918 mi); Idaho National Engineering Laboratory, 3,000 km (1,866 mi); Hanford Site, 3,610 km (2,282 mi); and Nevada Test Site, 2,930 km (1,818 mi). Distances along rail routes are about the same except for Savannah River Site, which is slightly longer.

Climatic Conditions

The climate of Houston is predominantly marine. The terrain includes numerous small streams and bayous, which together with the nearness to Galveston Bay, favor the development of both ground and advective fogs. Prevailing winds are from the southeast and south, except in January, when frequent passages of high-pressure areas brings invasions of polar air on prevailing north winds.

Temperatures are moderated by the influence of winds from the Gulf, which results in mild winters and, on the whole, relatively cool summer nights. Another effect of the nearness of the Gulf is abundant rainfall, except for rare extended dry periods. Polar air penetrates the area frequently enough to provide stimulating variability in the weather.

The average number of days with minimum temperatures of 32°F or lower is only about 7 per year at the city's National Weather Service office and about 15 per year at William P. Hobby Airport, which is about 16 km (10 mi) southeast of the city. Most freezing temperatures last only a few hours because they are usually accompanied by clear skies.

Monthly rainfall is evenly distributed throughout the year. In past years, about 75 percent of the total precipitation has been between 76.2 and 152.4 cm (30-60 in). Since thundershowers are the main source of rainfall, precipitation may vary substantially in different sections of the city on a day-to-day basis.

Records of sky cover for daylight hours indicate about one-fourth of the days per year as clear with maximum of clear days in October. Cloudy days are relatively frequent from November to May, and partly cloudy days are more frequent from June through September.

Snow rarely occurs; however, on February 14-15, 1895, 51 cm (20 in) of unmelted snow was measured. Heavy fog occurs on an average of 16 days a year, and light fog occurs about 62 days a year in the city, but the frequency of heavy fog is considerably higher at William P. Hobby Airport. Destructive windstorms are fairly infrequent, but both thundersqualls and tropical storms occasionally pass through the area (DOC, 1992d).

D.2.2.9 Lake Charles, LA

The city of Lake Charles, the seat of Calcasieu Parish, is located on the east side of the Lake. It is the center of large industries such as chemical, petroleum, natural gas, fish oil, synthetic rubber, salt, seafood, and rice. The Port of Lake Charles is situated 3 km (2 mi) south of the city on the east bank of the Calcasieu Lake, and is 52 km (32 mi) from the Gulf of Mexico (DOC, 1992a). A map of the port is shown in Figure D-40.

A Federal project provides for a channel 12.8 m (42 ft) deep across the outer bar, from 12.2 to 12.8 m (40 to 42 ft) through the jetties, and 12.2 m (40 ft) to the Port of Lake Charles.

The United States Coast Pilot (DOC, 1992a) reports: "In recent years a substantial number of oceangoing vessels of increased size and draft have been entering the Calcasieu River Channel and proceeding to and from berths as far up the channel as the Port of Lake Charles. The channel, however, has not been appreciably widened in recent years. Based upon reported marine casualties to vessels and upon reported navigational problems arising from the increased oceangoing traffic, and after consultation with local marine interests, the Coast Guard Captain of the Port (COTP) has developed certain guidelines to enhance safe navigation."

The longest berth in the terminal is 274 m (900 ft). Lake Charles has no international container carriers serving the port and serves primarily as a breakbulk, dry bulk, and project cargo niche port (AAPA, 1993 and 1994; Southern Shipper, 1993). It can handle limited container traffic on breakbulk vessels (about 30,000 20-ft equivalent units in 1992) (Southern Shipper, 1993). Most of the area around Calcasieu Lake is wetlands, and ships entering the port pass by the Sabine National Wildlife Refuge.

Like all Gulf Coast ports, it is subject to severe hurricanes and tropical storms. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Lake Charles, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a very low seismic zone with an acceleration of less than 0.075 g.

Lake Charles, LA's climatic and environmental conditions are similar to those of the Port of New Orleans, LA. Port of New Orleans information is presented in Section D.2.2.14.

The 1990 census population estimate for this port vicinity was approximately 73,800 with a population density on the order of 940 persons/km² (2,434 persons/mi²). The approximate distances to the five potential sites on interstate routes are: Savannah River Site, 1,100 km (700 mi); Oak Ridge Reservation, 960 km (600 mi); Idaho National Engineering Laboratory, 3,400 km (2,100 mi); Hanford Site, 4,000 km (2,500 mi); and Nevada Test Site, 3,200 km (2,000 mi). Distances along rail routes are about the same.

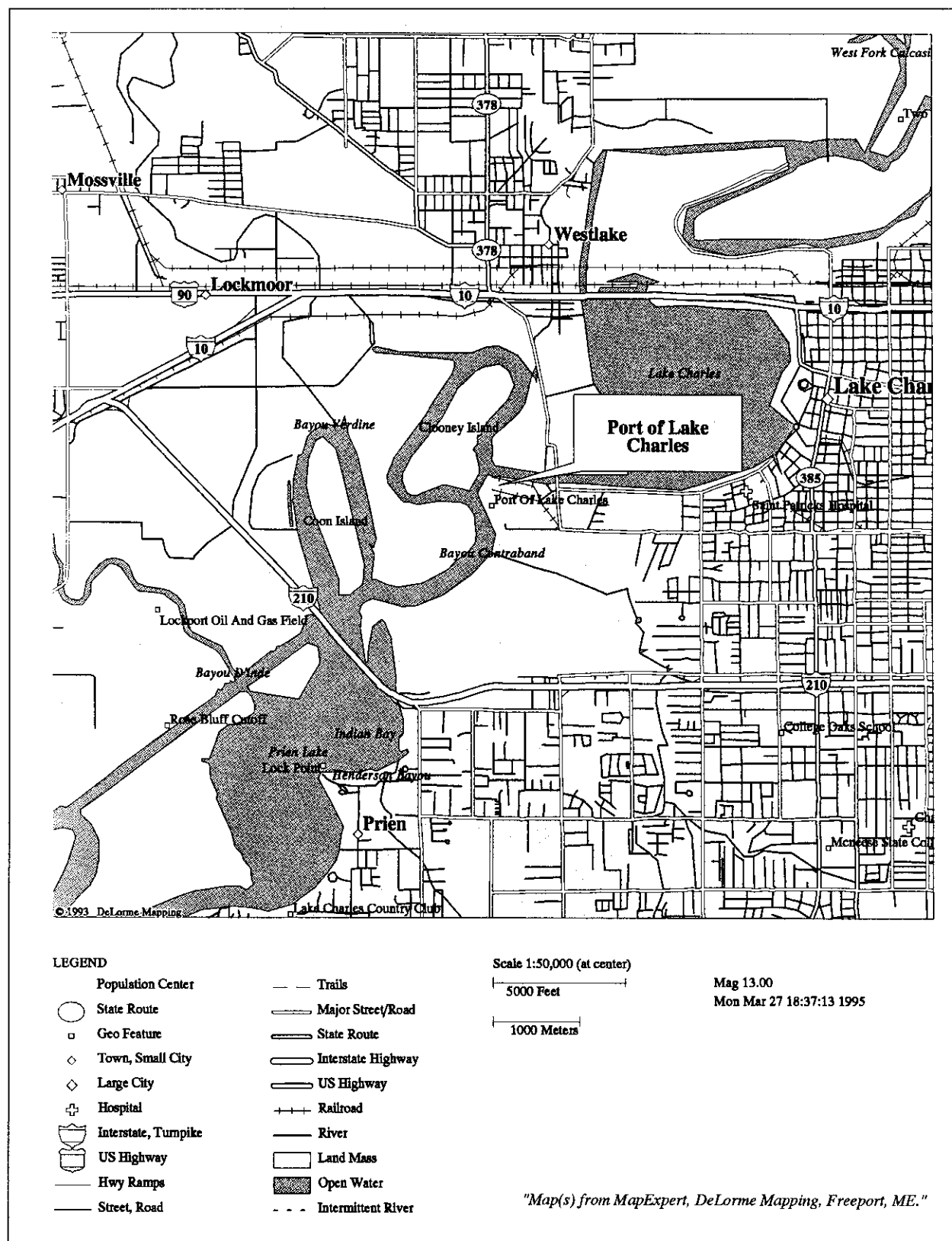


Figure D-40 Map of the Port of Lake Charles, LA

D.2.2.10 Long Beach, CA

Long Beach and Los Angeles Harbors, although divided by a political boundary, form a single geographic and economic port entity. The harbors occupy a major part of San Pedro Bay. The Port of Long Beach, one of the largest ports on the Pacific Coast, has extensive foreign and domestic traffic with modern facilities for the largest vessels. Most of the channels in Long Beach Harbor are maintained at more than the project depth of 10.7 m (35 ft). The entrance to Middle Harbor is 3.5 km (2.2 mi) from the Queens Gate entrance at the Pacific Ocean. The channel from the Pacific Ocean is straight, short, and direct (DOC, 1992b). A map of the port is shown in Figure D-41.

The Long Beach Harbor Department is a semi-autonomous agency of the City of Long Beach, CA. The Department is responsible for the operation, control, and development of the municipally owned port facilities. Long Beach is a large port (a load center) with 1,040 ha (2,816 acres) of land area, 12 piers, and 77 operational berths serving about 5,700 vessels annually. The port handles about 75 million metric tons (83 million tons) of revenue cargo annually, of which approximately 35 million metric tons (39 million tons) is containerized general cargo equivalent to 1.8 million 20-ft equivalent units (POLB, 1993a-d; AAPA, 1993).

Long Beach is a multi-terminal port and is host to seven container terminals with 38 container cranes and 243 ha (600 acres) devoted to container handling facilities. Additionally, there are facilities for petroleum and petroleum-related products, dry bulk materials, automobiles, steel, citrus, palletized general cargoes, and other commodities. The port functions as a "landlord" port leasing out its facilities to terminal and ship operating companies. Two of the container terminals (California United Terminals - Pier E, and Pacific Container Terminal - Pier J) are operated as "public" facilities. California United Terminals also has two roll-on/roll-off ramps and rail spurs (POLB, 1993a-d; AAPA, 1993; Janes's, 1992).

The dock/quay length available for cargo ships is as follows: California United, Pier E, Berths E24-E26 — 594 m (1,950 ft) long, and Pacific, Pier J, Berths J245-J247 — 1,006 m (3,300 ft) long. The corresponding depths alongside at mean low water are: California United with 14-15.2 m (46 to 50 ft), and Pacific Container with 14.9 m (49 ft). The five cranes at California United are all 40 metric ton (44 ton) container cranes. Pacific Container has six, 40 metric ton container cranes (Jane's 1992; AAPA, 1993; POLB, 1993a-d).

California United Terminals is served by an 11 lane main gate, which appears to be about 0.8 km (0.5 mi) from the "on" ramp to I-710 (the Long Beach Freeway), all within the confines of the port area. Pacific Container Terminal has similar ease of access to I-710, estimated to be a distance of about 1.9 km (1.2 mi), also within the port terminal. California United Terminals has shipside rail service provided by the Harbor Belt Line Railroad. Plans are to extend Belt Line rail service to Pacific Container Terminal by April 1994. The line connects with the major rail systems serving the Greater Los Angeles/Long Beach areas such as the Union Pacific, Santa Fe, and Southern Pacific Railroads. The latter operates a 97 ha (240 acre) intermodal container transfer facility which was built by the POLB to serve the marine terminals of both Long Beach and Los Angeles. The terminals are about 6.4 km (4.0 mi) from the double stack intermodal container transfer facility yard. The Santa Fe and Union Pacific railroads offer similar intermodal transfer facilities at their respective yards in east Los Angeles (D&B, 1993; Jane's, 1992; AAPA, 1993).

The port is served by a number of the world's largest container ship lines including: ACL, BHP/MTL, CCNI, COSCO, CGM, Cho Yang, Cool Carriers, DSR-Senator Line, EAC, Hanjin, Hapag-Lloyd, Hyundai, K-Line, Maersk Line, Nedlloyd Lines, OOCL, Philippine National Line, P & O, Sea-Land and TMM (Jane's, 1992; D&B, 1993; AAPA, 1993).

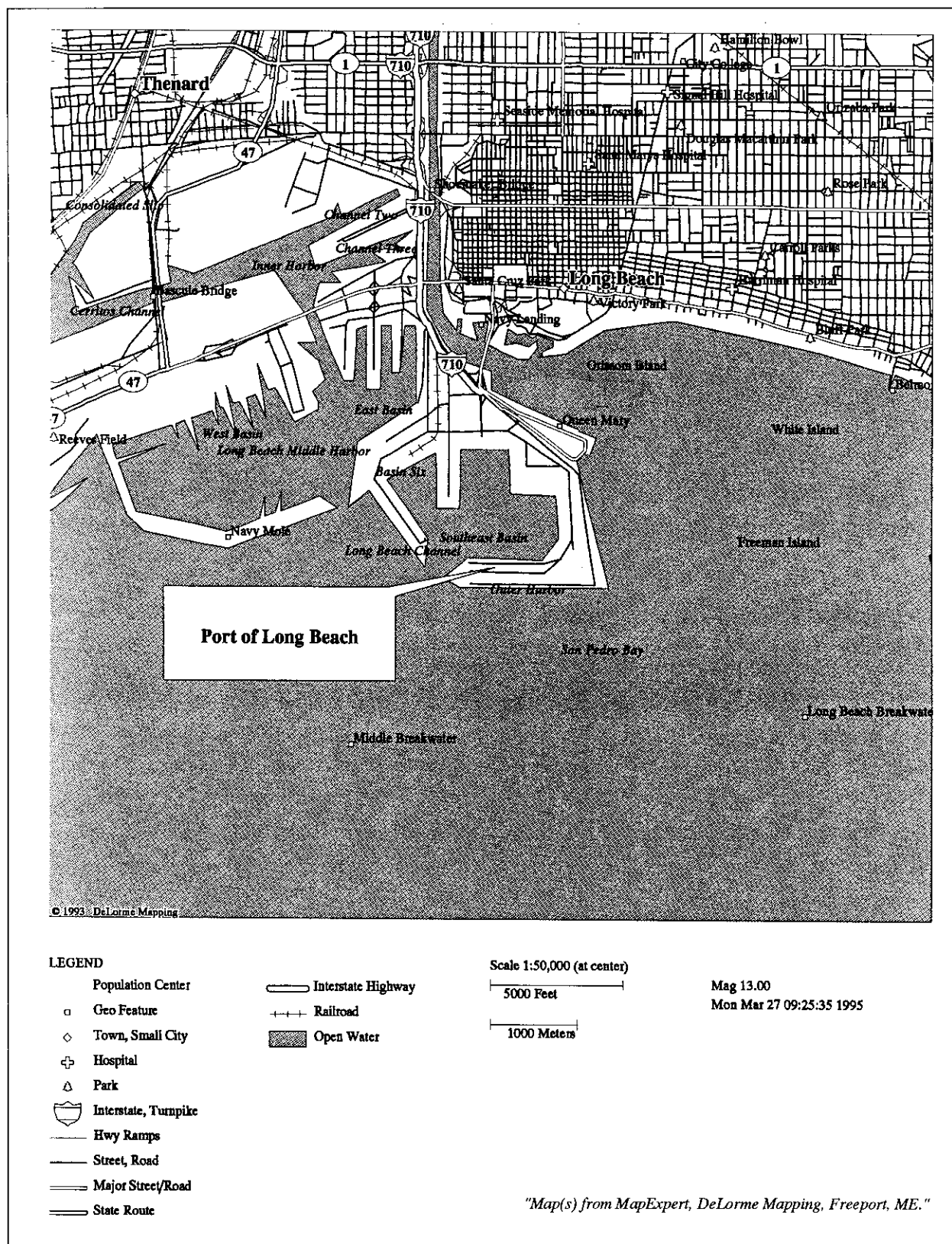


Figure D-41 Map of the Port of Long Beach, CA

Other Pertinent Information: Terminal operators are responsible for the security of their respective facilities. Container terminals are fenced with controlled access and the security forces are port employees (Powell et al., 1994). The port contracts with the City of Long Beach for police and fire protection services. The City of Long Beach stations two fireboats within the port area. There are locations within the terminals for temporary storage of hazardous materials (Hilliard, 1993) but no special areas set aside (Powell et al., 1994).

There are no known environmentally sensitive areas within the harbor area. However, the port claims a long-term interest in maintaining a high quality environment and supports a number of programs to prevent contamination of air and harbor water quality. It was the first recipient of the American Association of Port Authorities Environmental Improvement and Protection Award, and enforces strict safety policies as well. "In the past 50 years, there have been no collisions between commercial vessels resulting in injuries . . . and no significant oil spills from oil transfers." (POLB, 1993b).

The port Marketing Manager did not know of any regulation prohibiting the handling of spent nuclear fuel (Hilliard, 1993). According to available data, the port has not handled spent nuclear fuel since at least 1979 (NRC, 1993; SNL, 1994). The Port of Long Beach does handle other hazardous cargoes and has a number of deep-draft petroleum and petrochemical terminals with attendant tanker traffic, including very large crude carriers. There appears to be good separation between these terminals and the two public container terminals at Pier E and Pier J (POLB, 1993a-d; Jane's, 1992).

Terminal operators contract with private hazardous materials response organizations to contain and control hazardous materials incidents on their premises. The Coast Guard and the Long Beach Fire Department's hazardous materials team are also used for emergency response. Hazardous materials training within the port is the responsibility of the port's Security Division. Port employees receive first responder training for hazardous cargo accidents (no Department of Transportation training), but the Fire Department is the responder for all port accidents (Powell et al., 1994). The Fire Department also calls on the county hazardous materials team as needed (Powell et al., 1994).

The port is physically separated from downtown Long Beach and has excellent highway connections. However, truck and/or rail passage from the terminals must pass through the heart of the adjoining communities that are large and densely populated, which makes the port less than ideal for spent nuclear fuel shipments.

The port is subject to severe earthquakes. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These requirements are shown in the Uniform Building Code (UBC, 1991). For the Port of Long Beach, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (70 mph). The port is located in a very high seismic zone with an acceleration of 0.40 g (the highest Uniform Building Code ranking). Nearby San Fernando, CA was the site for one of the worst recorded earthquakes in the contiguous United States with a Modified Mercalli Intensity XI, in February 1971 (Bolt, 1978). Numerous other serious earthquakes with Intensities ranging from IX to X have also occurred in the last century. Long Beach was the site for a Intensity IX earthquake on March 10, 1933, which also resulted in numerous deaths, injuries, and building damage (Bolt, 1978).

The 1990 population within 16 km (10 mi) of the port terminals was 1,014,418. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 914,000; Oak Ridge Reservation, 823,000; Idaho National Engineering Laboratory, 692,000; Hanford Site, 617,000; and Nevada Test Site, 518,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-7 in Section D.1. The distances to

the five potential sites on interstate routes are: Savannah River Site, 3,940 km (2,443 mi); Oak Ridge Reservation, 3,610 km (2,246 mi); Idaho National Engineering Laboratory, 1,580 km (979 mi); Hanford Site, 2,000 km (1,241 mi); and Nevada Test Site, 645 km (401 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The environmental conditions for Long Beach are the same as those for Los Angeles. These are reported in Section D.2.2.11 below.

Climatic Conditions

Similar to the Los Angeles area, the climate of Long Beach, CA, is influenced significantly by the local topography. The Pacific Ocean has a moderating effect on the diurnal temperature range, which is greater than that observed further inland at the Los Angeles International Airport. In general, winter months are cool and wet followed by warm, dry summer months. Early morning clouds and fog, which are quite common during the late evening and early morning hours, generally burn off by late morning, resulting in sunny, pleasant daytime conditions during summer (NOAA, 1993f).

D.2.2.11 Los Angeles, CA

Los Angeles and Long Beach Harbors, although divided by a political boundary, form a single geographic and economic port entity. The harbors occupy a major part of San Pedro Bay. The Port of Los Angeles, one of the largest ports on the Pacific Coast, has a history of leading the Pacific Coast ports in terms of tonnage handled. It has extensive facilities to accommodate all types of traffic, and is the only southern California port at which passenger vessels call regularly (POLA, 1994).

The channel from the Pacific Ocean is straight, short, and direct. The Los Angeles Main Channel is maintained at 13.7 m (45 ft). The Super Tanker Channel to the deep draft facilities is maintained at 12.2 m (40 ft). The majority of the port facilities are located within 4.8 km (3 mi) of the harbor entrance (DOC, 1992b). A map of the port is shown in Figure D-42.

Worldport LA, the name adopted by the Los Angeles Harbor Department for the Port of Los Angeles, is a proprietary and self-supporting department of the City of Los Angeles reporting to a Board of Harbor Commissioners. The Worldport LA functions as a landlord operator administering its own budget, operations, and development programs (POLA, 1994).

Worldport LA is one of the country's largest, multi-terminal ports, and claims the title of the busiest container port in the United States. In fiscal year 1992, Worldport LA handled 2,154,890 20-ft equivalent units — the highest volume in the port's history. The port is also a cruise ship terminus handling over three-quarter million passengers in 1992 (AAPA, 1993; POLA, 1994).

Worldport LA encompasses approximately 1,684 ha (4,160 acres) of land area and 1,425 ha (3,520 acres) of sheltered waters. It has 36 cargo handling terminals, including six dedicated container terminals and three "Omni" terminals (which handle containers and breakbulk) with a total of 34 container cranes, on 45 km (28 mi) of waterfront. Of the three Omni terminals, Berths 142-146 (operated by Worldport LA) is a public facility with no "tenant" ship lines. The remaining two Omni terminals, RDP and Indies Terminals, are managed by private terminal operating companies but are open to public use (Jane's, 1992; AAPA, 1993; D&B, 1993). A multi-billion dollar, outer harbor Pier 300 development is underway with completion scheduled by the year 2010 (some terminals may be open during the period analyzed in this EIS) (POLA, 1994).

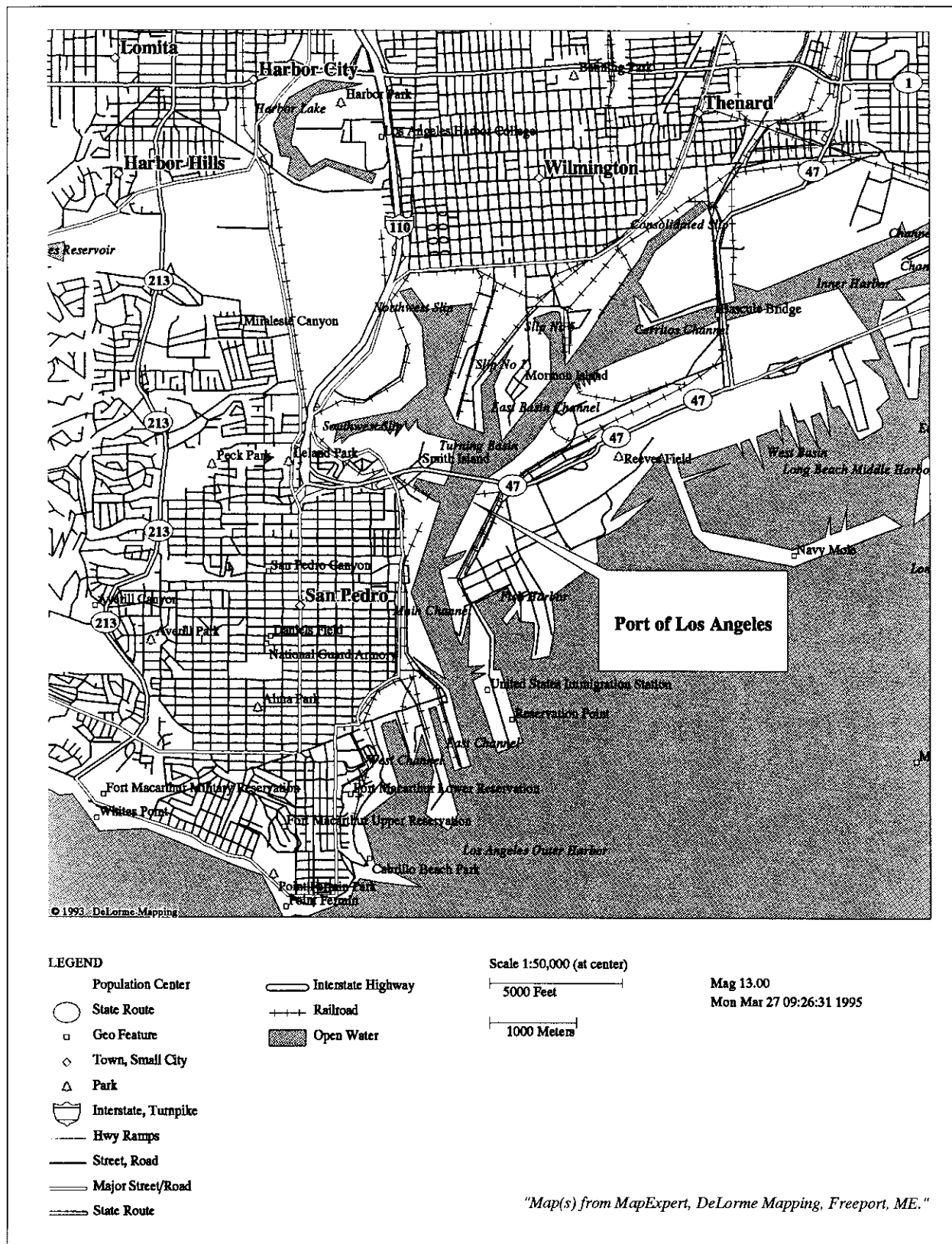


Figure D-42 Map of the Port of Los Angeles, CA

Worldport LA Berths 142-146: Dock/Quay lengths are 853 m (2,800 ft) and depths alongside at mean low water are 10.67-11.3 m (35-37 ft) at mean low water. Worldport LA berths have crane capacities of three 40.6 metric ton (45 ton) container cranes (Jane's, 1992; AAPA, 1993).

RDP Terminal: Berths 174-181 have lengths of 1,006 m (3,300 ft) and depths of 10.67 m (35 ft) at mean low water. Capacity of RDP cranes is two 40.6 metric ton container cranes (Jane's, 1992; AAPA, 1993).

Indies Terminal: Berths 216-227 have total lengths of 1,128 m (3,700 ft) and depths of 13.72 m (45 ft) at mean low water. The Indies berths have three 40.6 metric ton (45 ton) container cranes (Jane's, 1992; AAPA, 1993).

Los Angeles terminals are served by the Harbor Freeway (I-110) and Terminal Island Freeway (Route 47) which connect with Interstate Highways 5, 10, 15, and 40. The Harbor Freeway begins within the Worldport LA port complex. Worldport LA is connected to the Southern Pacific Transportation Co., Union Pacific, and Santa Fe railroads by the Harbor Belt Line Railroad, jointly owned by the Los Angeles Harbor Department and the three railroads. Belt Line tracks extend to cargo ship berths at each of the Omni Terminals. Intermodal connections are presently made at the intermodal container transfer facility described for the Port of Long Beach, which is approximately 8 km (5 mi) away. A new intermodal container transfer facility is under construction on Terminal Island and there are major infrastructure improvement projects underway to facilitate and expedite rail and truck traffic to the port through the Greater Los Angeles Metropolitan area (POLA, 1994).

Worldport LA is host to more than a dozen cruise ship lines and about 40 cargo ship lines. A partial list of container lines calling at the port include: American President Lines, Australia-New Zealand Direct Line, Orient Overseas Container Line, Philippines, Micronesia & Orient Lines, Yang Ming Line, Mitsui O.S.K. Lines, Kawasaki Kisen Kaisha ("K" Line), Dole Fresh Fruit, Columbus Line, Blue Star PACE Ltd., Matson Navigation Co, NYK Line, Neptune Orient Lines, Evergreen Line, Barber Wilhelmsen, Blue Star Line, d'Amico Line, Italia Line, Nedlloyd Lines, and Slosna Plovba (Jane's, 1992; D&B, 1993).

Other Pertinent Information: The Port of Los Angeles has its own police force that patrols the waterfront around the clock by boat, helicopter, automobile, and bicycle (Leong, 1993). Port security is extensive and extremely well-organized. The port police are responsible for the safety and security of all passenger, cargo, and vessel operations at Worldport LA. They also monitor vessel berthings for possible wharf damage and issue hazardous cargo and dangerous goods permits. In addition, terminal operators have their own unarmed security personnel. All terminals also have areas for segregation and temporary storage of dangerous cargoes (Verhoef et al., 1994).

Fire protection is provided by the Los Angeles Fire Department which maintains five fire stations within the port and operates five fireboats. Two additional fireboat berths and stations are under construction. Response time is within five minutes. First responders for accidents receive Occupational Health and Safety Administration training but do not yet receive Department of Transportation training (Leong, 1993; Verhoef et al., 1994).

A port spokesperson did not know of any ordinances prohibiting the importation of spent nuclear fuel (Leong, 1993). A port spokesperson thought the port had handled spent nuclear fuel shipments in the past (Note: Database searches of shipments over the last decade do not show Los Angeles as a port for receipt of spent nuclear fuel; presumably these past shipments were other types of radioactive materials) (Leong, 1993). Item 1715 of Los Angeles Port Tariff No. 4, effective July 1, 1990, provides for the handling of radioactive and/or fissile materials, provided special written permission is received from the Executive

Director and U.S. Department of Transportation/Coast Guard Regulations are fully complied with (POLA, 1994). However, a spokesperson indicated that it was unlikely the port would accept spent nuclear fuel shipments (Verhoef et al., 1994).

The port police are the primary responders to hazardous materials incidents, backed up by the Los Angeles Fire Department and the United States Coast Guard. Based on Tariff Item 1715 referred to above, and the fact that radioactive shipments have occurred in the past, it is assumed port police have an adequate handling plan in place for radioactive materials. Worldport LA is an active participant in the Shoreline Emergency Network, a regional oil spill network organized to respond to coastal oil spill emergencies. The port police are trained in hazardous materials handling and are in charge of such operations. It is not known to what extent individual terminal operators are trained in hazardous materials response, but given the size and complexity of the port activities, it is assumed adequate hazardous materials training is provided. The combined ship accident history for the Ports of Long Beach and Los Angeles for the period of 1991-1993 is the lowest of all the major west coast ports (USCG, 1994b).

Worldport LA has a number of environmental programs underway that are designed to mitigate damage done to the marine environment in the past, and to prevent or lessen additional negative environmental impacts in the future. The port has a very active recreational/tourist component and, due in part to the presence of oil production facilities within the port, there is heightened environmental sensitivity on the part of the port community. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Los Angeles, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (70 mph). The port is located in a very high seismic zone with an acceleration of 0.45 g. Like most Southern California cities, the port is subject to severe earthquakes. Two relatively recent severe earthquakes in Southern California (along the San Andreas fault system along the Pacific and North American tectonic plates) occurred March 10, 1993, in Long Beach (Modified Mercalli Intensity IX) and February 9, 1971, in nearby San Fernando (Modified Mercalli Intensity VIII-XI). Both resulted in numerous deaths and injuries and caused massive structural damage to buildings.

The 1990 population within 16 km (10 mi) of the port terminals was 1,124,493. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 936,000; Oak Ridge Reservation, 639,000; Idaho National Engineering Laboratory, 519,000; Hanford Site, 725,000; and Nevada Test Site, 334,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 3,930 km (2,440 mi); Oak Ridge Reservation, 3,550 km (2,204 mi); Idaho National Engineering Laboratory, 1,510 km (940 mi); Hanford Site, 2,070 km (1,286 mi); and Nevada Test Site, 580 km (359 mi). Distances along rail routes are slightly longer.

Environmental Conditions

Several wildlife refuges are located around the San Pedro Bay area. The Seal Beach National Wildlife Refuge is approximately 16 km (10 mi) east from the port area. The Bolsa Chica Ecological Reserve is located about 20 km (11 mi) east from the port area. The Abalone Cove Ecological Reserve is about 16 km (10 mi) around Point Fermin to the west of the port area. Several areas of biological significance lie along the passageway to the ports. These include the Channel Islands National Marine Sanctuary, about 60 km (43 mi) to the southwest of the port entrance, and the Santa Catalina Island Area of Special Biological Significance, about 28 km (17 mi) southwest of the port entrance (FWS, 1981c).

The water quality of the harbor waters at the ports is generally considered good. Areas in the inner harbor with limited waterflow experience infrequent periods of poor water quality. There is a wider range of salinity in the inner harbor than in the outer harbor, with higher values at the bottom than at the surface (U.S. Army, 1990).

The waters of the Los Angeles-Long Beach Harbor contain a variety of marine habitats, some natural and some manmade. Numerous fish species use the habitats in the harbor, including several recreational (e.g., barred sand bass and white croaker) and commercial (e.g., anchovy and halibut) value, for all or part of their life cycle (U.S. Army, 1990). Commercial fishing operations for crabs and spiny lobsters also are in San Pedro Bay. Other sport-fishing in the bay includes flatfish, grunions, California halibut, white seabass, kelp bass, Pacific bonito, and Pacific barracuda (FWS, 1981c). Shallow waters are important nursery areas for several fish species. At least 60 species of water-associated birds use the harbor, primarily for resting and foraging (U.S. Army, 1990).

Several threatened or endangered species are present at least seasonally in San Pedro Bay (Kobetich, 1994; U.S. Army, 1990). The endangered California least tern breeds in the area from April through August. California brown pelicans are present all year feeding on the fish in the harbor and resting on the breakwaters and other structures. Peregrine falcons are present in the region but are seldom sighted in the harbor. Other endangered birds around the ports include the light-footed clapper rail and the marbled morrelat. The western snowy plover (threatened) and the long-billed curlew, which is a candidate species, have been spotted infrequently in the harbor. Other candidate species, including the elegant tern, harlequin duck, loggerhead shrike, reddish egret, and white-faced ibis, can be found in the harbor area.

Within the Seal Beach National Wildlife Refuge, the wetlands portion supports a wide variety of fish and invertebrate as well as residential and migratory bird populations. The bay provides habitat for the light-footed clapper rail, Belding's savannah sparrow, the California least tern and the California brown pelican, all of which are endangered (U.S. Army, 1990). The Bolsa Chica Ecological Reserve provides habitat for the California least tern, the light-footed clapper rail, the California brown pelican, Belding's savannah sparrow (State protected), and the salt marsh bird's-beak, a member of the figwort family. The Belding's savannah sparrow is strictly associated with pickleweed, which is not found within the ports; therefore this species is not expected to be found directly in the ports. The reserve is also used by the coast horned lizard, monarch butterfly, snowy plover, and numerous bird species such as gulls, terns, sandpipers, herons, and egrets.

With regard to marine mammals, no species of cetaceans (whales, dolphins) actually inhabit regions in-shore of the breakwater, and their occurrence within the harbor is sporadic and infrequent. Visitors include the common dolphin, the Pacific white-sided dolphin, and gray whale (endangered). Groups of bottlenose dolphins have been observed swimming just outside the breakwater. The eastern Pacific gray whale migrates through California waters twice yearly in a route between the Bering Sea and Baja California. The southward migration occurs between November and February, while the northward return generally takes place off of California between March and May. While the gray whales usually stay outside the harbor mouth, approximately three to four accidentally enter the harbor every year. The California sea lion and the harbor seal, both nonendangered, have been sighted in the area of the harbor. The California sea lion is known to occasionally haul-out on the harbor breakwater and sometimes can be seen swimming in the harbor. The harbor is not considered a birthing or important feeding habitat for the California sea lion, although sea lions could presumably forage within the harbor (U.S. Army, 1990).

Climatic Conditions

The dominant geographic influences on the climate of the Los Angeles basin are the Pacific Ocean and the southern California coastal mountain ranges. Marine air covers the coastal plain for the majority of the year, but inland air does occasionally migrate into the region. Pronounced differences in temperature, humidity, cloudiness, fog, sunshine, and rain occur over fairly short distances along the coastal plain due to the local topography and the decreased effect of the marine environment further inland. However, in general, temperature ranges are least and humidity highest close to the coast, while precipitation increases with elevation in the foothills. Prevailing daytime winds are from the west, with nighttime and early morning winds generally light and from the east and northeast. During the fall, winter and spring months, dry, gusty northeasterly winds (e.g., Santa Ana winds) blow over the southern California mountains. Precipitation occurs mainly during the winter months. Thunderstorms are rare along the coast, but increase in frequency as one approaches the coastal ranges. Fog and low visibility are frequent problems for aircraft navigation at the Los Angeles International Airport (NOAA, 1993e).

D.2.2.12 Miami, FL

Miami is Florida's most populous city and is located 8 km (5 mi) from the Gulf Stream on the east coast of Florida. It is an internationally famous winter resort and a popular yachting center. Miami is also a deepwater port; considerable foreign commerce passes through Miami and it is a major cruise port. Miami's cruise ship traffic has earned it the title of "Cruise Ship Capital of the World" (Southern Shipper, 1993). In addition to being a major shipping and cruise ship center, the Port of Miami is located in a popular resort area known for its beaches, fishing, recreational boating, and tropical landscape. The approach to Miami is open, but with strong tidal currents of 1.0 to 2.1 meters-per-sec (2 to 4 knots) in the entrance between the jetties. A Federal project provides for depths of 11 m (36 ft) to the main port facilities (DOC, 1993d; Southern Shipper, 1993; AAPA, 1993; Jane's, 1992). The port occupies 273 ha (675 acres) of land. It is situated on two interconnected islands, Dodge and Lummus, which lie in an east-west orientation due east of the City of Miami and west of the barrier island resort area of Miami Beach. The Miami Beach resort area forms the northern boundary of the harbor entrance. The major port facilities are within 5 km (3 mi) of the entrance from the Atlantic Ocean. A map of the port is shown in Figure D-43.

Miami's freight terminals serve as a hub for distribution and transshipment of cargo (largely tropical fruits and vegetables) to and from Latin America. The Port of Miami is an arm of the Dade County Seaport Department which functions as a "landlord" port. Almost 60 shiplines connect the port to most major countries in the world (Jane's, 1992; D&B, 1993; Southern Shipper, 1993). In 1994, nearly 520,000 20-ft equivalent-units were handled in the port (AAPA, 1994).

Lummus Island Terminal: The 91 ha (225 acre) terminal on the south side of the island is seaward of Dodge Island and just inside the entrance to the port. It is Miami's principal container handling facility with six container gantry cranes, including three new post-Panamax cranes and a new roll-on/roll-off berth. Activities at Dodge Island are primarily cruise ship, roll-on/roll-off, and breakbulk cargo oriented. Combined facilities consist of four container berths, 14 roll-on/roll-off berths, and 12 cruise ship berths. A private container terminal for shallow draft vessels is located on Causeway Island at the eastern end of the MacArthur Causeway, which parallels the ship channel north of Lummus and Dodge Islands (Southern Shipper, 1993).

This terminal has marginal wharf area of 1,067 m (3,500 ft). The roll-on/roll-off berths have 413 m (1,356 ft) of marginal wharf while the Dodge Island breakbulk has 853 m (2,800 ft) of marginal wharf. The passenger terminals have 2,373 m (7,785 ft) of marginal wharf. Depths alongside Dock/Quay are

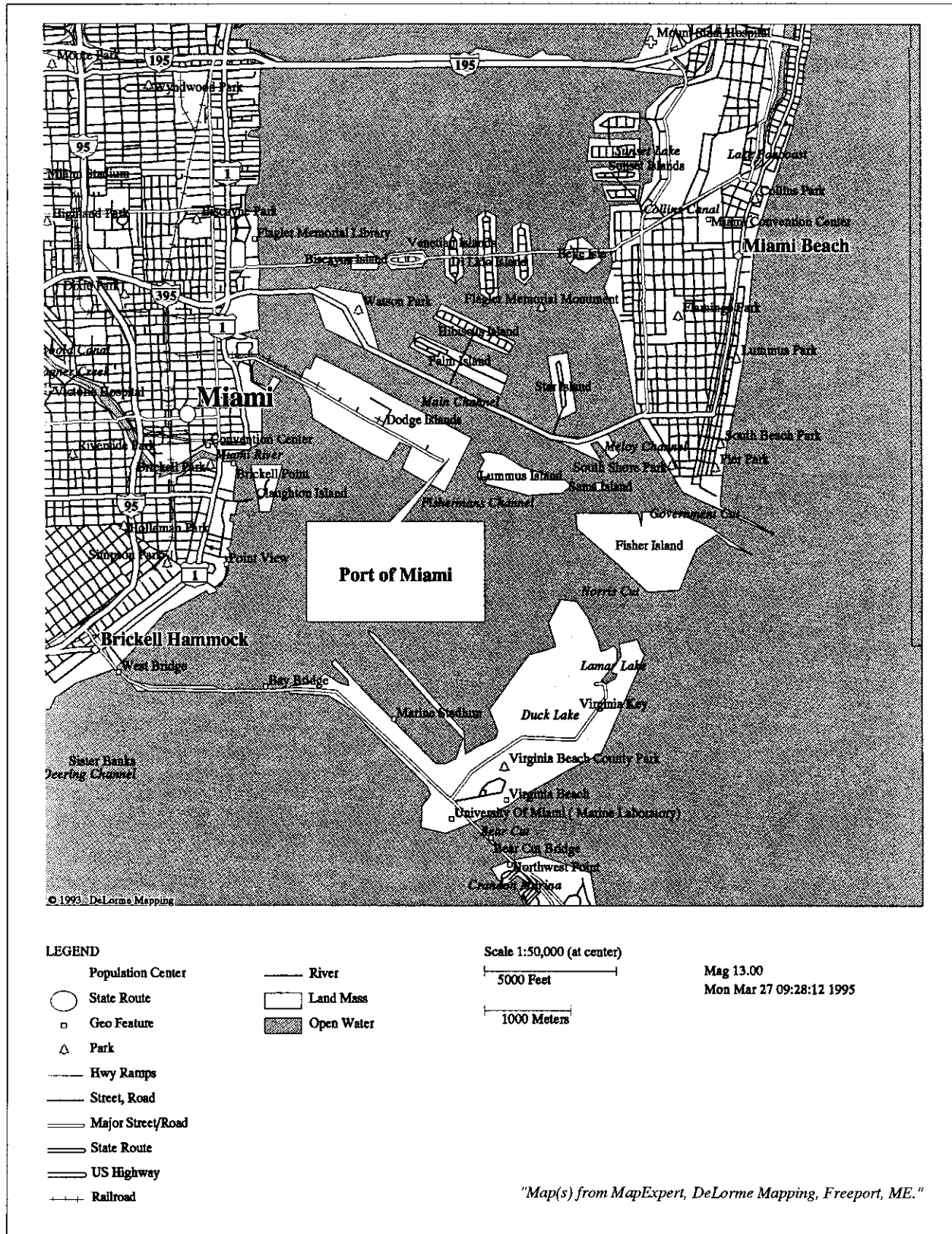


Figure D-43 Map of the Port of Miami, FL

noted as: Lummus Container Berths 1 and 2 with 12.8 m (42 ft) at mean low water. Berths 3 and 4 have 11.73 m (38.5 ft) at mean low water. On the north side of Dodge Island, the depth is 7.62-10.97 m (25-36 ft) at mean low water.

Crane capacities at Lummus Container Berths consist of three 50.8 metric ton (56 ton) container gantry cranes and three 40.6 metric ton (45 ton) container gantry cranes.

The Port of Miami is accessible via a five-lane, fixed bridge spanning the Intracoastal Waterway. It is approximately 1.2 km (0.75 mi) from the Biscayne Boulevard exit of I-395 to Dodge Island via NE 2nd Avenue in downtown Miami. I-395 is a connector to I-95 as well as all other south Florida highways. There are 5.2 km (3.2 mi) of trackage within the Port of Miami including a four-track marshalling yard. Rail connections are with the Florida East Coast and CSX Railroads.

Port users include Agromar, Argentine Line, Barber Blue Sea, Bottachi Line, Central American Shippers, CCNI, CGM, Chilean Line, Ecuadorian Line, Empremar, Flota Mercante Grancolombiana, Hapag Lloyd, Hoegh Line, Italian Lines, Ivaran Lines, Kirk Line, Lykes Line, Maersk Line, Navieras De Puerto Rico, Shipping Corp of India Transnave, Mexican Line, Spanish Line, Wallenius Transroll, and Zim Container Service (Jane's, 1992; Southern Shipper, 1993; D&B, 1993).

Other Pertinent Information: Containers discharged at Lummus Terminal must travel down the center of both islands and past the extensive cruise line terminals located on the north side of Dodge Island. Although travel on city streets on the mainland is for a very short distance, it is through an urban area which is believed to be heavily developed. The port recently completed a new \$1.8 million, eight-lane security gate and cargo control facility on Dodge Island to the east of the bridge. Each lane is equipped with Regiscope photographic clearance systems (Southern Shipper, 1993).

Port officials did not respond to a faxed questionnaire or telephone calls for information, and it is not known if there is a designated area for temporary storage of hazardous cargoes. The port has no prior experience handling spent nuclear fuel (NRC, 1993; SNL, 1994). However, the Port of Miami is primarily a general cargo, container, and cruise ship port with no petroleum berths or other terminals for handling hazardous or dangerous goods. Passenger operations are considered a conflicting use. Since port officials did not respond to requests for information regarding emergency response capabilities, it is not known whether hazardous materials or spent nuclear fuel training exists for port workers.

There are no known wildlife habitats or sanctuaries in the immediate area; however, there is a high-level of environmental sensitivity in this area. The port's physically separate island locations, strictly controlled access, and limited use of city thoroughfares are very desirable features. However, the port is in relatively close proximity to the heavily populated Miami Beach area adjoining the harbor entrance (Government Cut) and roughly 0.8 km (0.5 mi) from downtown Miami.

The likelihood of severe natural phenomena, such as high winds and earthquakes, are reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Miami, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a low seismic zone with an acceleration of less than 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 833,057. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 336,000; Oak Ridge Reservation, 443,000; Idaho National Engineering Laboratory, 845,000; Hanford Site, 894,000; and Nevada Test Site, 908,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances

to the five potential sites on interstate routes are: Savannah River Site, 1,200 km (748 mi); Oak Ridge Reservation, 1,460 km (906 mi); Idaho National Engineering Laboratory, 4,570 km (2,842 mi); Hanford Site, 5,240 km (3,258 mi); and Nevada Test Site, 4,740 km (2,945 mi). Distances along rail routes are slightly longer, except for Savannah River Site, which is slightly less.

Environmental Conditions

The State of Florida has classified Biscayne Bay near Port of Miami as a Class III water body. This classification indicates that the waters are suitable for recreation, and propagation and maintenance of a healthy, well balanced population of fish and wildlife (FL DEP, 1994). In addition, the State of Florida has classified the Biscayne Bay, where the Port of Miami is located, as an "Outstanding Florida Waterway." As previously noted, Outstanding Florida Waters are generally waters located within national parks, state parks, national seashores, marine sanctuaries, or aquatic preserves. Other waters located near Port Everglades that are designated as Outstanding Florida Waters include Biscayne Bay National Park and the Bill Bags State Recreation Area. These waterways are afforded special protection by State environmental regulations (FL DEP, 1994).

The Biscayne Bay, in the vicinity of the Port of Miami, is characterized as a high salinity estuarine habitat (generally greater than 20 parts per thousand). There are both commercial and recreational fish and invertebrates found near the port. These aquatic species include: stone crabs, shrimp, spiny lobster, sharks, sand seatrout, drum, kingfish, mullet, Florida pompano, bluefish, mackerel, tarpon, ladyfish, snapper, grouper, grunts, jewfish, snook, greater amberjack, crevalle jack, silver perch, blue runner, Atlantic dolphin, short-finned pilot whale, false killer whale, and pygmy sperm whale (FWS, 1982c).

Protected species found near the Port of Miami include the loggerhead sea turtle and the West Indian manatee (Richards, 1994). The U.S. Fish and Wildlife Service reported that the Port of Miami is located in designated critical habitat for the endangered west indian manatee (Johnson, 1995). In addition, the U.S. Fish and Wildlife Service reports that the following protected, listed marine species are known to occur in Dade County: atlantic hawksbill turtle (endangered), atlantic ridley turtle (endangered), atlantic loggerhead turtle (threatened), atlantic green turtle (endangered), leatherback turtle (endangered), american crocodile (endangered), and the american alligator (threatened/similar appearance). Protected bird species in Dade County include the bald eagle (endangered), cape sable seaside sparrow (endangered), ivory-billed woodpecker (endangered), kirtland's warbler (endangered), arctic peregrine falcon (threatened), wood stork (endangered), everglades snail kite (endangered), bachman's warbler (endangered), roseate tern (threatened), and the piping plover (threatened) (Johnson, 1995).

Wildlife refuges located near the port area are the Bill Baggs Cape Florida State Recreation Area and the Biscayne Bay Aquatic Preserve. They are both located within 20 km (12 mi) of the Port of Miami. Protected species found in these areas include the loggerhead sea turtle, the West Indian manatee, and the peregrine falcon. Birds of interest found in these areas are: the spotted breasted oriole, songbirds, fulvous whistling duck, and various shorebirds (FWS, 1982c).

Climatic Conditions

The climate of the southeast Florida region is essentially subtropical marine, which features long, warm summers with abundant rainfall, generally followed by a mild, dry winter. The influence of the ocean and numerous bays is seen in the small diurnal temperature range (generally $<10^{\circ}$) and the rapid warming of any cold air masses that invade this portion of the State. The predominant windflow is from the east-southeast, which generates conditions right at the coast that are often different than those encountered further inland, due to land-induced frictional effects. Hurricanes occasionally effect the area, with the

months of September and October exhibiting the highest frequencies. However, destructive tornadoes (not associated with tropical systems) are rare. Waterspouts are frequently spotted offshore during the summer months, but rarely cause any loss of life or property damage (NOAA, 1993b).

D.2.2.13 Military Ocean Terminal, Oakland, CA

The Military Ocean Terminal, Bay Area, is located in the Outer Harbor of the Port of Oakland, adjacent to the east entrance to the Oakland Bay Bridge (descriptions of Oakland ship channels also apply to Military Ocean Terminal, Bay Area and are not repeated here). The facility is located approximately 16 km (10 mi) east of the Golden Gate Bridge, which spans the Pacific Ocean entrance to San Francisco Bay to the south and San Pablo Bay to the north. The single pier (Wharf 7) currently available for military cargo is directly opposite the commercial Sea-Land and Public Container Terminals, and located within the Oakland Army Base (MTMCTEA, 1990). The facility has the largest sealift workload of any military traffic ports on the West Coast, averaging on the order of 3,000 metric tons (3,300 tons) of cargo per year (the 1994 shipments of Patriot missiles to South Korea were shipped from Wharf 7). See the descriptions of the Port of Oakland for more information regarding truck and rail access, maps, populations, etc. A map of the terminal is shown in Figure D-44.

The Bay Bridge Terminal, adjacent to Military Ocean Terminal, Bay Area, operates Military Ocean Terminal, Bay Area wharves 6 and 6.5 as Berths 8 and 9 for its commercial operation (Jane's, 1992; MTMCTEA, 1990). Wharf 7 is 445 m (1,459 ft) long, with 10.6 m (35 ft) depth alongside. Wharf 7 has a single 91 metric ton gantry crane for all breakbulk operations and a container spreader that can be attached for limited container handling (MTMCTEA, 1990). A floating crane of comparable capacity is also available. Stern loading roll-on/roll-off operations are not feasible at the wharf.

There are more than 8.1 ha (20 acres) of open storage space near the wharf, and a transit shed at the wharf provides more than 13,000 m² (141,000 ft²) of covered storage. More than 65,000 m² (700,000 ft²) of additional covered space is available on the Army Base (MTMCTEA, 1990).

Trucks can access the wharf for direct loading from ships at the facility. Access to Interstates 580, 680, or 880 is directly adjacent the Army Base through a largely industrial area at the Port of Oakland. Residential areas are within a few kilometers of the Base and the Port of Oakland.

The entire length of Wharf 7 is served by rail, making direct ship-to-rail loading possible for receipt of incoming cargo. Rail movements are carried out by two Base locomotives, which can move rail shipment to the adjacent and expanding Oakland Intermodal Terminal. The Intermodal Terminal is serviced by the Southern Pacific and Union Pacific rail systems and connections with the Atchison, Topeka, and Santa Fe Railroad intermodal yard about 19 km (12 mi) north of the port (MTMCTEA, 1990).

Other Pertinent Information: Since the facility is part of the Oakland Army Base, it is well lighted, fenced, and patrolled by gate guards and roving patrols. There are no full time longshoremen at the facility, and trained, experienced longshoremen are hired from the large pool of stevedores (1,000) normally working at the port.

The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Military Ocean Terminal, Bay Area, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (70 mph). The port is located in a very high seismic zone with an acceleration of 0.40 g (see seismic information for the Port of Oakland for more details).

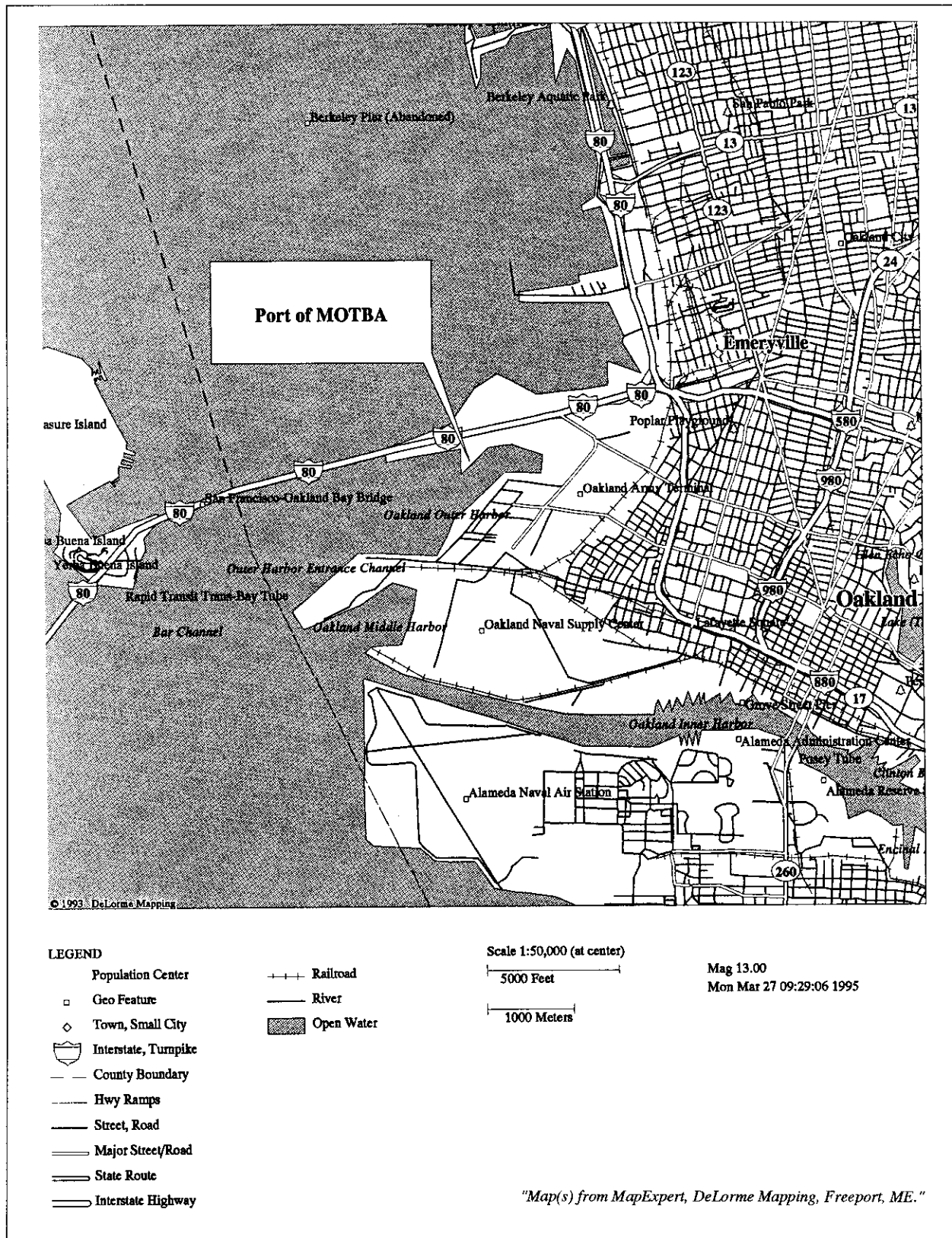


Figure D-44 Map of the Military Ocean Terminal, Oakland, CA

Area 1990 census population and density figures are 1,110,549 and 1,323 persons/km² (511 persons/mi²), respectively. The 1990 population within 16 km (10 mi) of the port terminals was 1,288,899. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 1,080,000; Oak Ridge Reservation, 786,000; Idaho National Engineering Laboratory, 367,000; Hanford Site, 359,000; and Nevada Test Site, 482,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 4,216 km (2,791 mi); Oak Ridge Reservation, 4,121 km (2,563 mi); Idaho National Engineering Laboratory, 1,548 km (963 mi); Hanford Site, 1,407 km (875 mi); and Nevada Test Site, 1,156 km (719 mi). Distances along rail routes are slightly longer.

The Military Ocean Terminal, Bay Area, is located in the Outer Harbor of the Port of Oakland. Climatic and environmental conditions for Military Ocean Terminal, Bay Area are the same as those for the Port of Oakland. These are presented in Section D.2.2.15.

D.2.2.14 New Orleans, LA

The Port of New Orleans is one of the largest ports in the United States. It is located on both sides of the Mississippi River with its lower limit about 129 km (80 mi) above the Head of the Passes from the Gulf of Mexico, and its upper limit about 185 km (115 mi) above Head of the Passes. A Federal project provides for a channel 13.7 m (45 ft) deep over the bar through Southwest Pass to Head of the Passes, and on to New Orleans. The Port of New Orleans' lower limit is about 160 km (98 mi) from the Gulf of Mexico via Southwest Pass. Southwest Pass is straight and well-marked. From the Head of the Passes to New Orleans, the river has a least width of 550 m (1,800 ft) and a clear, unobstructed channel (DOC, 1992a). A map of the port is shown in Figure D-45.

The seven-person Board of Commissioners of the Port of New Orleans, is appointed by the Governor from a list of nominees drawn from industry, civic, and educational groups from the three parishes (counties) in which the Port of New Orleans' terminals are located. The Board, a state agency, sets policies and regulations for port operations. It also appoints the president and chief executive officer of the Port of New Orleans who, together with a staff of professional managers, are responsible for day-to-day operation of the port.

New Orleans is a multi-terminal port with predominantly publicly owned terminals and a few private terminals. The port is strictly a "landlord" operator, leasing all of its terminals to private operators and/or shipping companies. Most of the large publicly owned terminals are located along the banks of the Mississippi (on the New Orleans side of the River), which generally runs in an east-west direction in the vicinity of the City. In 1994, the port handled over 250,000 20-ft equivalent units of containerized cargo (AAPA, 1994).

France Road Container Terminal is the Port of New Orleans' principal container handling facility. It occupies 71.55 ha (177 acres) of land and is situated on the west bank of the industrial canal in the southwestern section of New Orleans at the intersection of the industrial canal with the Mississippi River/Gulf Outlet. Berths 1 and 4 are leased to Sea-Land and Navieras De Puerto Rico respectively, and Berths 5 and 6 are public terminals. Berth 1 has two 30.5 metric ton (34 ton) container cranes. Berths 5 and 6 are supported by three container cranes [one 30.5 metric ton (34 ton) container crane and two 40.64 metric ton (45 ton) container cranes], a marshalling yard of 195,077 m² (2.1 million ft²), two container freight stations with 12,193 m² (131,120 ft²) of consolidating space, and a roll-on/roll-off ramp

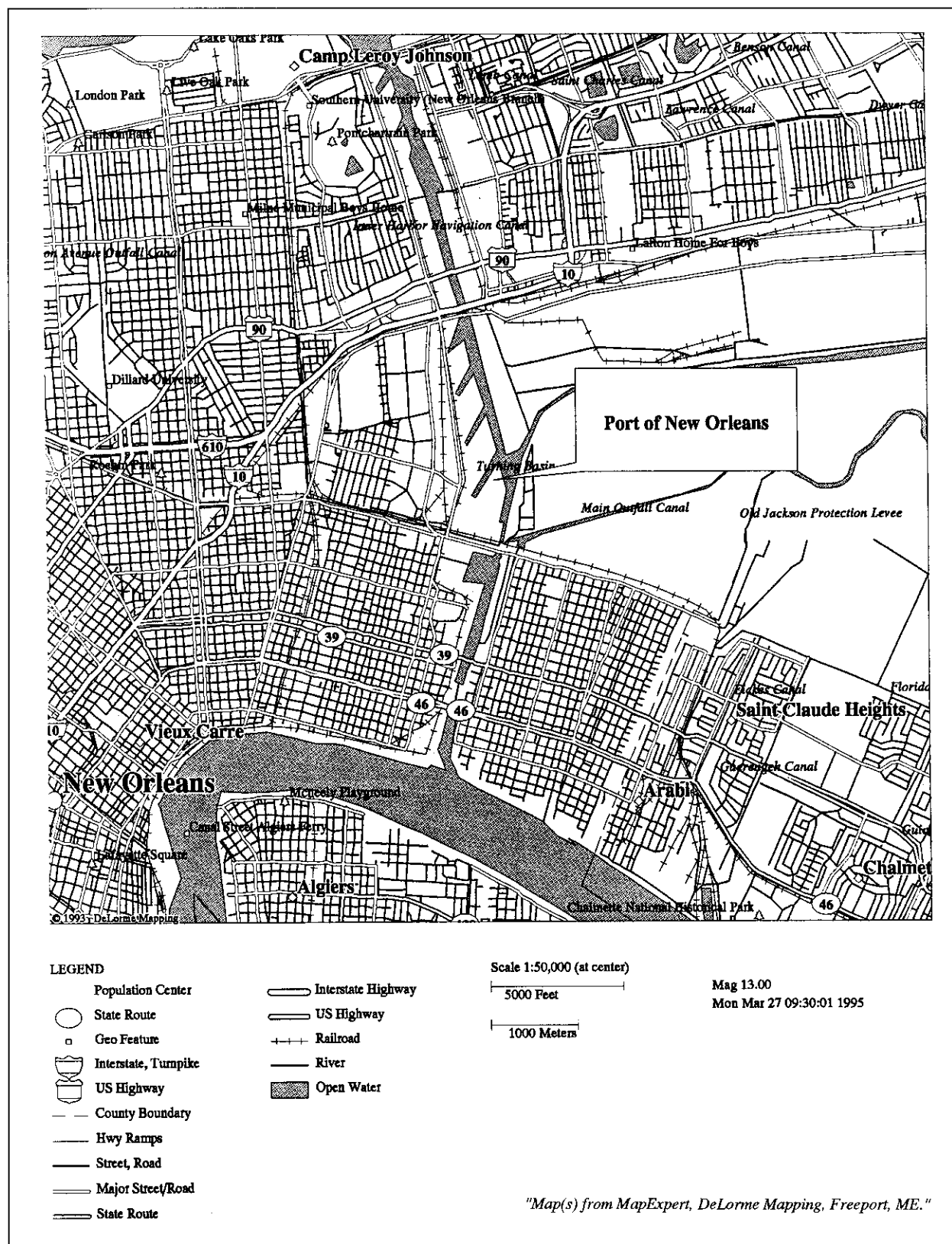


Figure D-45 Map of the Port of New Orleans, LA

at Berth 6. Berths 5 and 6 have a combined length of 518 m (1,700 ft) of marginal wharf with water depth alongside ranging from 9.75 - 10.97 m (32 - 36 ft) at mean low water (AAPA, 1993; Janes's, 1992; D&B, 1993; Southern Shipper, 1993; PON, 1994).

The France Road Public Container Terminal is located in a port industrial district that appears to be separate from residential areas and a considerable distance from the downtown New Orleans business district. This terminal is about 2.4 km (1.5 mi) from Interstate Highway 10 and U.S. Route 90 — major east-west highways — via Alvar Street or Florida Avenue, which are heavy truck routes. I-10 connects with I-49 to Shreveport, where it meets I-20. The Terminal has good truck and rail access, but waterway access is via the relatively narrow industrial canal with a lock near the entrance and several bridges en route. The city-owned Public Belt Railroad connects the France Road and other terminals on the Mississippi, Industrial Canal, and Mississippi/Gulf Outlet with the CSX, Illinois Central, Kansas City Southern, Norfolk Southern, Southern and Union Pacific Railroads. In the case of France Road Terminal, the Belt Railroad tracks serve the site, but not the pier apron.

The Port of New Orleans is port-of-call for over 50 steamship lines providing breakbulk and container freight service to virtually all of the world's major port cities. A partial list of these lines includes ABC Container Line, Argentine Line, ART Ocean Line, Atlantic Container Line, Baltic Shipping, Bank Line East Africa, Boss Line, China Ocean Shipping Co., Contship Container Line, Chilean Line, Daiichi-Chuo Shipping Line, Delmas/AAEL, Egyptian National, Forest Lines Inc., Hapag-Lloyd, Hoegh Line, Hyundai Merchant Marine, Industrial Maritime Carriers, Italia Line, Lykes Brothers Steamship Co., Maersk Inc., NCSCA, Pakistan National Shipping, Pan Ocean, Safbank, Sea-Land, Tecomar, Toko, Torm West Africa, Turkish Cargo Lines, United Arab Shipping, Waterman/LASH, Wilhelmsen Line, and Zim Container Line (Jane's, 1992; D&B, 1993).

Other Pertinent Information: The port has its own security force with police powers. The France Road Terminal is secured by fencing and controlled access. There are locations within the terminal for isolation of hazardous materials. The Port Harbor Police are the first line of defense with respect to hazardous materials accidents, followed by the Coast Guard and Louisiana State Police, who have primary responsibility for enforcing Department of Transportation Regulations. The port has an "elaborate" notification system in case of accidents on Port Authority terminals, beginning with the shipper or consignee of the goods. The New Orleans Fire Department also has a hazardous materials team. Hazardous materials training is the responsibility of the individual terminal operating companies. While the level of training at each terminal is uncertain, given the large quantities of hazardous materials passing through the port, some training is certain (Parker, Spalluto, and Cefalu, 1993).

Port officials know of no ordinances or regulations prohibiting the importation of spent nuclear fuel through the Port of New Orleans, and thought the port may have handled spent nuclear fuel in the past. However, other data indicate the port has not handled spent nuclear fuel since at least 1979 (NRC, 1993; SNL, 1994). The port spokesperson indicated that shipments of radioactive nuclear fuel (not spent nuclear fuel) have been shipped through the port and may still be coming in. Apparently these shipments were from South Africa (Parker, Spalluto, and Cefalu, 1993).

The Port of New Orleans is primarily a breakbulk and general cargo/container port. It is also a major river barge terminus for barge lines on the Mississippi River system. Although there is considerable tank ship and barge traffic on the River, tank terminals tend to be located on the opposite side of the river and/or outside the City limits. Conflicting use of the waterway is not considered a major factor with regard to handling spent nuclear fuel. However, a U.S. Coast Guard accident database established in 1990 shows that an extremely high number of accidents occur on the transit from the Gulf to the port (USCG, 1994a). During the period 1991 through the third quarter of 1993, there were 790 collisions, 825 allisions, and

1,065 hard groundings reported (see 46 CFR 4.05-1 for reporting requirements and definitions). The 2,680 accidents involved one of the following: vessel damage in excess of \$25,000 and/or left the vessel unseaworthy, or without power or steering, or severe injury or death. The port 1993-1994 Annual Directory indicates that during this period, there were about 7,100 vessel transits (PON, 1994). Since the accident statistics include barge accidents (and New Orleans has large barge traffic), this number is rather high for oceangoing vessels, but no data are yet available yet to refine the information.

Other than flooding from severe hurricanes and tropical storms, and general environmental concerns, there are no known special environmental or wildlife issues in or near the port area. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of New Orleans, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a very low seismic zone with an acceleration of less than 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 782,868. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 266,000; Oak Ridge Reservation, 256,000; Idaho National Engineering Laboratory, 455,000; Hanford Site, 504,000; and Nevada Test Site, 687,000. Populations along rail routes to these sites are slightly smaller for Idaho National Engineering Laboratory, Hanford Site, and Nevada Test Site and much larger for Savannah River Site and Oak Ridge Reservation. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,020 km (634 mi); Oak Ridge Reservation, 960 km (594 mi); Idaho National Engineering Laboratory, 3,510 km (2,184 mi); Hanford Site, 4,180 km (2,600 mi); and Nevada Test Site, 3,450 km (2,145 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The State of Louisiana has classified the waters of the Industrial Canal and the Mississippi River Gulf Outlet as suitable for primary and secondary water recreational activities and the propagation of fish and wildlife. The Mississippi River supports all of these uses in addition to being used as a drinking water supply source (Fabens, 1994).

The Mississippi River Gulf Outlet, in the vicinity of the France Road Terminal, is characterized as a high salinity estuarine habitat (generally greater than 20 parts per thousand). The entire canal travels through marshlands. Aquatic species found in these types of marshlands and surrounding areas in Louisiana include: shrimp, blue crab, eastern oyster seatrout, Atlantic croaker, drum, spot, kingfish, sheepshead, flounder, mullet, sea catfish, gulf menhaden, bay anchovy, crevalle jack, and Atlantic bottlenose dolphin (FWS, 1982d).

As ships approach the Mississippi River Gulf Outlet from the north they must travel past the Breton National Wildlife Refuge and Breton Wilderness. Birds of interest in these areas include: peregrine falcon, brown pelican, shorebirds, wading birds, herons, egrets, white ibis, least bittern, gallinules, waterfowl, bird hawks, osprey, magnificent frigate-bird, white pelican, songbirds, warblers and diving ducks. The peregrine falcon and brown pelican are protected species. Aquatic species found in these areas include: loggerhead sea turtle, spotted sea trout, drum, bluefish, cobia, and mackerel. The loggerhead sea turtle is a Federally protected species (FWS, 1982d). Travelling north into the Mississippi Gulf River Outlet towards the France Road Terminal ships must pass near the Biloxi Wildlife Management area.

Climatic Conditions

The city of New Orleans is essentially surrounded by water. Thus, the influence of the Gulf of Mexico and the surrounding bayous, lakes, and marshes are significant. The climate can best be described as humid, with the surrounding water significantly reducing the diurnal temperature range. Between mid-June and mid-September, almost daily, sporadic thunderstorms occur and prevent the temperature from rising much above 90°F. From mid-November through mid-March, the region is influenced alternatively by moist, tropical air masses from the south and from cold, dry continental air masses from the north. The general extratropical storm track is to the north of New Orleans but occasional systems do develop offshore of the city, causing sudden drops in temperature and an increase in precipitation. The cold Mississippi River water and the surrounding marsh areas increase the occurrence of fog in the late winter and early spring months, particularly when light southerly winds are advecting warm, moist tropical air over the area. A rainy period between mid-December through mid-March occurs annually, with the remaining fall/spring months (e.g., October/November, April/May) being relatively dry. The dominant rainfall event during the summer are thunderstorms. Severe thunderstorms with damaging winds are rare. However, the area is subject to the occasional landfalling hurricane. Waterspouts are common in the offshore area, but rarely cause property damage or loss of life (NOAA, 1992l).

D.2.2.15 Oakland, CA

Oakland, located on the eastern shore of the San Francisco Bay, is directly opposite San Francisco. It is the second largest port on the Bay and is a leading containership terminal on the Pacific Coast. The approach to San Francisco and the transit across the Bay to Oakland is open, however, there are restricted areas such as passing under the Golden Gate and Oakland Bay Bridges. There is considerable traffic in the Bay area. A Federal project channel depth of 10.6 m (35 ft) exists to and in the outer harbor. The same depth is maintained in part of the inner harbor. The width passage from the ocean to San Francisco Bay is reduced to approximately 1,125 m (0.7 mi) at the Golden Gate Bridge pier. The distance from the Golden Gate Bridge to the entrance of Oakland Harbor is less than 16 km (10 mi) (DOC, 1992b). A map of the port is shown in Figure D-46.

Oakland is a huge multi-terminal port complex consisting of Outer, Middle, and Inner Harbor cargo terminals leased to terminal operators and/or container shipping lines. The Port of Oakland is part of the Oakland Municipality. The Port Administration is strictly a "landlord" owner and does not operate any facilities. There is a growing trend for "secondary" use by other shipping lines of privately leased terminals, such as Matson's Outer Harbor 7th Street terminal—Berths 32-34, blurring the distinction between public and private use (Jane's, 1992; AAPA, 1993). The port handled over one million 20-ft equivalent units of containerized cargo in 1992 (AAPA, 1994). Public use container and general cargo facilities include:

Outer Harbor: The Seventh Street Marine Container Terminal, Berths 37 and 38, has three container cranes, 14.4 ha (35.6 acres) of terminal area, and storage for over 2,500 20-ft equivalent units. The Outer Harbor Public Container Terminal, Berth 23, has two container cranes, 16.2 ha (40 acres) of terminal area, and storage for over 3,500 20-ft equivalent units. The Bay Bridge Terminal, Berths 8-10, (a combination general cargo (breakbulk), container, and roll-on/roll-off facility) has 20.6 ha (50.9 acres) of terminal area and 7,072 m² (76,130 ft²) of covered storage. This terminal was inoperative for several years due to earthquake damage sustained in 1989 but is now back in operation (Adams and Renteria, 1994). Quay lengths are as follows: Seventh Street Marine Containers Terminal — 592 m (1,942 ft) of marginal wharf; OHPCT — 274 m (900 ft) of marginal wharf; and Bay Bridge Terminal — 926 m (3,038 ft) of marginal wharf.

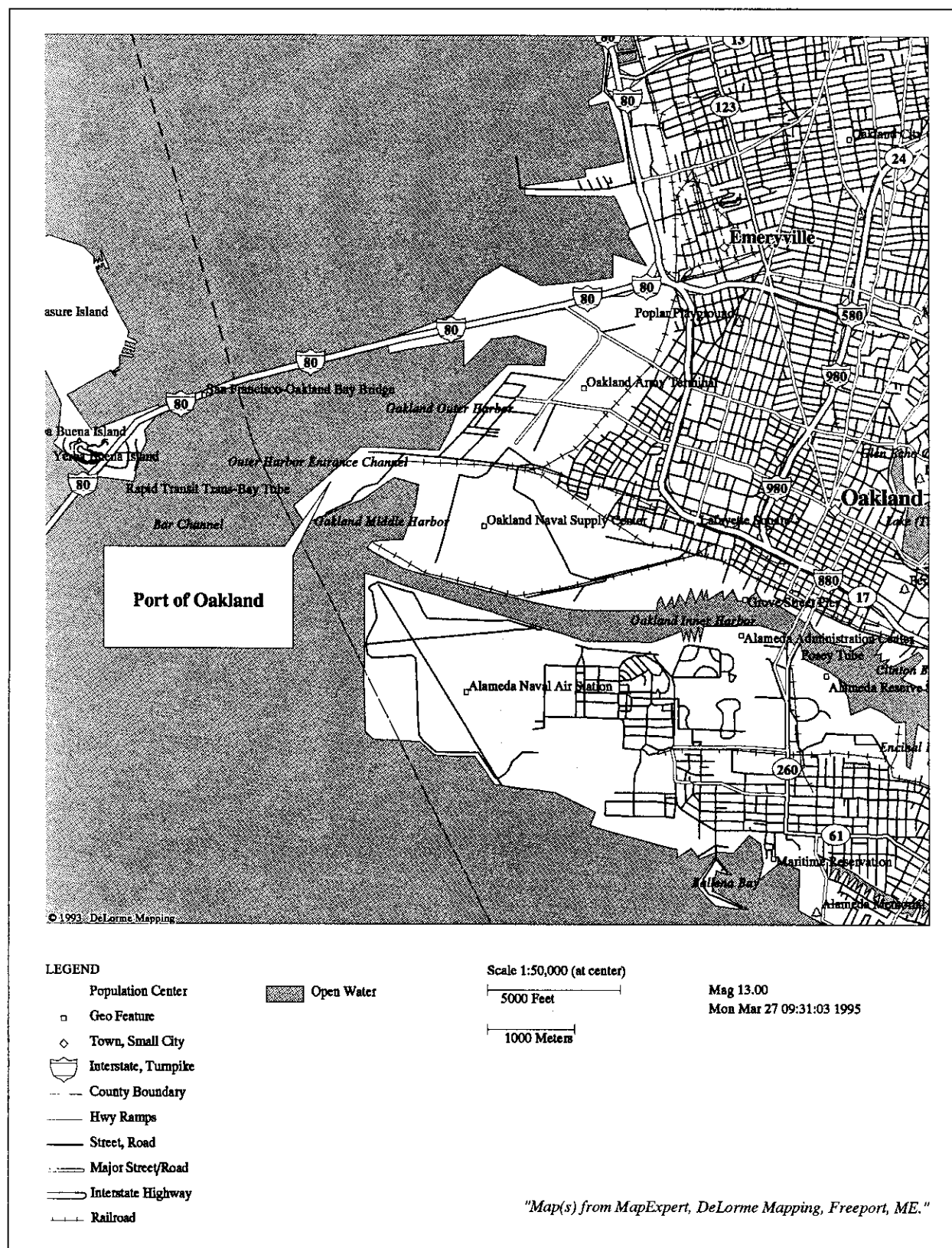


Figure D-46 Map of the Port of Oakland, CA

Crane capacities at Seventh Street Marine Containers Terminal include two 40.6 metric ton (45 ton) container cranes and one 30.5 metric ton (34 ton) container crane. Outer Harbor Public Container Terminal has crane capacity of two 40.6 metric ton (45 ton) container cranes (Jane's, 1992; AAPA, 1993).

Inner Harbor: The Charles Howard Terminal, Berths 67 - 69, has three container cranes, 19.8 ha (48.9 acres) of terminal area, and storage for over 3,000 20-ft equivalent units. Quay lengths at Charles Howard Terminal are as follows: two marginal wharves of 501 m each (1,642 ft) and one 173 m (568 ft) wharf. The Charles Howard Terminal has crane capacity consisting of two 40.6 metric ton (45 ton) container cranes and one 50.5 metric ton (56 ton) container crane (Jane's, 1992; AAPA, 1993).

Seventh Street Marine Containers Terminal, Outer Harbor Public Container Terminal, and Charles Howard Terminal have depths alongside at mean low water of 12.2 m (40 ft). Approach channels are currently limited to 10.6 m (35 ft). A dredging program to 12.8 m (42 ft) is scheduled for completion by 1995 (Jane's, 1992; AAPA, 1993).

Located just south of the Oakland Bay Bridge, the Port of Oakland has immediate access to Highway I-80 for shipments to Idaho National Engineering Laboratory and/or transcontinental shipments, and Highways I-580/I-5 for east coast shipments via the southern route I-40. The truck route from Seventh Street Marine Containers Terminal to the interstate appears to be almost entirely within the port complex in an area dedicated to cargo handling and shipping functions. The Port of Oakland is served by the Union Pacific, Southern Pacific, and Santa Fe Railroads (D&B, 1993). The port has an intermodal container transfer facility, but there does not appear to be direct rail service to container berths at the Seventh Street Marine Containers Terminal (Jane's, 1992; AAPA, 1993).

The Port of Oakland is served by many of the world's largest container lines, including American President Lines, Atlantic Container Lines, Australia-New Zealand Container Line, Cho Yang, DSR Senator Line, EAC Lines, Hanjin Shipping Co., Hapag-Lloyd, Hawaiian Marine, Hyundai, Italian Line, "K" Line, Maersk Lines, Matson Navigation Co., Mitsui OSK, Neptune Orient, NYK Lines, OOCL, Sea-Land Service, and Yang Ming Line (Jane's, 1992; AAPA, 1993; D&B, 1993). Four additional lines switched from San Francisco to Oakland in 1994 (Mitchell, 1994; Adams, 1994).

Other Pertinent Information: Security of the port is provided by perimeter fencing and unarmed guards from the International Longshoremen Union who maintain 24-hour patrol and surveillance (Adams, 1993; Adams and Renteria, 1994). Therefore, it is assumed that foreign research reactor spent nuclear fuel shippers using the port would have to provide their own security force.

The Port Commission has an active ban on the handling of spent nuclear fuel in recognition of community anti-nuclear sentiment which led to a citizens legislative initiative banning such shipments (subsequently struck down by a Federal court). The port handles radioactive and other hazardous materials shipments but officials did not know if Oakland has ever handled spent nuclear fuel shipments (Adams, 1993). The available data shows that Oakland has received spent nuclear fuel shipments, with the last shipment in 1988 (NRC, 1993).

Outer Harbor container and general cargo terminals are situated at the entrance to the port and there appears to be little or no conflict with other hazardous cargoes including petroleum products shipped through the port's breakbulk and liquid bulk terminals located within the Inner Harbor (Adams, 1993; Adams and Renteria, 1994).

Emergency response capability is the responsibility of the individual terminal operators. Each terminal operator must have an Emergency Contingency Plan approved by the Port Commission and the U.S. Coast Guard. The Oakland Fire Department has a hazardous materials response team, and the response time for

emergencies is about five minutes (Adams and Renteria, 1994). Beginning in November 1994, the port is increasing its emergency response capabilities. Financed by a new \$50 million bond, the port is adding a new fire station, an Emergency Operations Center, new fire boats, a completely equipped hazardous materials van, and a fire-fighting bucket to be lifted in by helicopter. The port also has agreements with neighboring cities (Berkeley, San Leandro, and Alameda) for emergency response (Adams and Renteria, 1994). It is the responsibility of individual terminal organizations and/or the port to provide hazardous materials instruction to the longshoremen (Adams, 1993; Adams and Renteria, 1994).

The Seventh Street Marine Containers Terminal is located in the Outer Harbor terminal complex seaward of the downtown Oakland business district, in an area primarily dedicated to port industrial usage with excellent connections to highways and rail service. However, the port is located in a large urban area in which congestions are to be expected. The San Francisco Bay Area has had only 31 collisions, but 21 fires were reported during the period 1991 to 1993—the worst fire record for major West Coast ports (USCG, 1994b).

There are no known areas of special environmental concern; however, there is strong concern for preservation of the environment, and this area is prone to severe earthquakes. On April 18, 1906, the Bay area was subjected to one of the largest recorded earthquakes in the contiguous United States, a Modified Mercalli Intensity XI (Bolt, 1978), due to movement along the fault line separating the Pacific and Continental tectonic plates (Hamilton, 1976). The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Oakland, the Uniform Building Code requires buildings to withstand wind speeds up to 110 km/hr (70 mph). Since the port is located in a very high seismic zone (the highest Uniform Building Code ranking), buildings must be constructed to withstand an acceleration of 0.40 g.

The 1990 population within 16 km (10 mi) of the preferred port terminals was 1,387,611. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 1,080,000; Oak Ridge Reservation, 786,000; Idaho National Engineering Laboratory, 367,000; Hanford Site, 359,000; and Nevada Test Site, 482,000. Populations along rail routes to these sites are slightly larger for Savannah River Site, Hanford Site and Nevada Test Site, but slightly smaller for Oak Ridge Reservation and Idaho National Engineering Laboratory. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 4,490 km (2,791 mi); Oak Ridge Reservation, 4,120 km (2,563 mi); Idaho National Engineering Laboratory, 1,550 km (963 mi); Hanford Site, 1,410 km (875 mi); and Nevada Test Site, 1,160 km (719 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The area around the terminal includes the San Francisco Bay to the south and the San Pablo Bay to the north. The Farallon Islands Game Refuge and the Point Reyes-Farallon Islands National Marine Sanctuary lie along the passageway to San Francisco. The San Francisco Bay National Wildlife Refuge and the Redwood Shores Ecological Reserve, both within the San Francisco Bay, are located 33 and 30 km south (20 and 18 mi), respectively from the Port of Oakland. The San Pablo Bay National Wildlife Refuge is located approximately 160 km (99 mi) north of the port.

San Francisco Bay

The Central Bay portion of the San Francisco Bay has several usage classifications, including industrial process supply, industrial service supply, navigation, water contact recreation, noncontact water recreation, ocean commercial and sport fishing, wildlife habitat, preservation of rare and endangered species, fish migration, fish spawning, shellfish harvesting, and estuarine habitat (State of California, 1986).

The San Francisco Bay comprises the largest estuarine ecosystem in California. The estuary encompasses a range of aquatic habitats, from the fresh and brackish waters of the Sacramento-San Joaquin River Delta to the saline waters of the Central and South Bay. The estuary provides habitat for a variety of aquatic species, some of which are important to commercial and recreational fisheries. These waters serve as a nursery area for marine, anadromous, and estuarine species, and provide a migration corridor for several anadromous species. Striped bass, Chinook salmon, steelhead trout, sturgeon, American shad, and English sole support important recreational fisheries in the estuary. Popular recreational fisheries in the Delta also include white catfish, largemouth bass, and sunfish (U.S. Army, 1994). In addition, the area around the port has populations of the common littlenecked clam, the soft-shelled clam, striped bass and flatfish, the California clapper rail, and the salt-marsh harvest mouse (FWS, 1981b).

Historically, marshlands bordering the Bay covered some 300 mi²; diking for agriculture and filling for development has reduced the marshlands to about 75 mi² (U.S. Army, 1994). The marshes and mudflats remaining along the margins of the Bay are very productive and provide habitat for a large number of birds and other wildlife. For instance, the area around the port has populations of the California clapper rail and the salt-marsh harvest mouse (FWS, 1981b). The Bay is a key resting, feeding, and wintering area for birds on the Pacific Flyway. This area annually supports a large number of shorebirds, wintering waterfowl, raptors, seabirds, and passerines. Shorebirds, wading birds, waterfowl, seabirds, songbirds, and other species migrate through the entire coastal zone in the San Francisco area (FWS, 1981b).

Several threatened or endangered species are known to occur or have the potential to occur occasionally or periodically in the San Francisco Bay area. These species include the California least tern, California brown pelican, the American peregrine falcon, and the winter-run chinook salmon (U.S. Army, 1994). The least terns breed in California from mid-May to August and nesting colonies are located on open flat beaches, sand flats, and bare dirt areas with sparse vegetation. The least tern generally migrates from the Bay Area in August and winters south of the United States. The California brown pelican uses the open waters of the central San Francisco Bay for feeding; they roost on rocks, jetties, and piers in the area. Although no brown pelicans breed in the San Francisco area (Bay or offshore), thousands move north and roost on coastal rocks during the June through October nonbreeding season. Several thousand pelicans summer in the San Francisco area. The American peregrine falcon is considered rare in the region. It formerly bred on the Farallon Islands, and though it has yet to breed there again, winter residents have returned and have stabilized in number. The American peregrine falcon is most common to the San Francisco Bay area during the winter, when migrants from farther north concentrate in the estuary. The nesting season is from spring thorough early summer, and several pairs nested on the San Francisco-Oakland Bay Bridge (U.S. Army, 1994). California condors and bald eagles are also found in the coastal zone around San Francisco Bay (FWS, 1981b). The winter-run chinook salmon passes through the Sacramento-San Joaquin Delta, San Pablo Bay, and San Francisco Bay during their upstream and downstream migrations. The adults are present in the Bay area from November to May, and the smelts migrate through the Bay from November through May. The winter-run chinook is fished commercially in North America from Kotzebue Sound, Alaska, to Santa Barbara, California (U.S. Army, 1994).

Open Ocean

Several threatened or endangered species occur either occasionally or periodically in the ocean offshore of the San Francisco area. These include the humpback whale, the blue whale, the sperm whale, and the Stellar sea lion (U.S. Army, 1994). The humpback whale, which has a worldwide range, is typically found in the San Francisco area from March through January. Summer feeding occurs from the Aleutian Islands to the Farallon Islands. The greatest number of blue whales within the Farallon Basin occurs in summer and early fall. The sperm whale regularly occurs in the Gulf of the Farallones in deep oceanic waters, and is rarely reported over the shelf. The Stellar sea lion ranges from California to the Bering Sea. Stellar sea lions have rookeries on Southeast Farallon Islands (as well as other California and Pacific coast sites). The sea lion breeds in the late spring and summer.

Climatic Conditions

The Oakland, CA, area is classified as a marine climate, which is characterized by mild and moderately wet winters, with cool, dry summers. The winter rains, which occur between November and March, account for over 80 percent of the total annual precipitation. Additionally, severe winter storms, with gale-force winds and heavy rains do occur occasionally. The diurnal temperature range is moderated substantially by marine environment. The summer weather is dominated by a cool sea breeze circulation and a sea fog that arrives in the late evening over the area. The fog generally burns-off in the early morning hours, resulting in relatively sunny summer days (NOAA, 1993d).

D.2.2.16 Palm Beach, FL

The Port of Palm Beach is located 2.0 km (1.1 mi) west of the entrance to Lake North Worth Inlet, which consists of a dredged cut, protected by two jetties, through the barrier beach which forms the resort city of Palm Beach. The port borders the communities of Riviera Beach on the north and West Palm Beach on the south, the latter being connected to Palm Beach by highway bridges spanning Lake Worth. The Port of Palm Beach is 110 km (68 mi) north of Miami and 417 km (259 mi) south of Jacksonville. A Federal project provides for a 10.7 m (35 ft) deep entrance channel with a 10.1 m (33 ft) inner channel to a turning basin of the same depth. The 121.9 m (400 ft) wide entrance channel narrows to 91 m (300 ft) and leads into a 442 m by 399 m (1,450 ft by 1,310 ft) turning basin. Port Authority-owned Peanut Island is located between the inlet entrance and Port of Palm Beach terminals. According to the port's 1993 Annual Report, the controlling depth of the entrance and turning basin was 10.1 m (33 ft) to not less than 7.6 m mean low water (25 ft) at the northern terminal extension (POPB, 1994). A map of the port is shown in Figure D-47.

The Port of Palm Beach is a landlord port with 77 ha (190 acres) of land. The Terminal has two slips and four marginal wharves totalling 1,536 m (5,039 ft) of berthing, including six roll-on/roll-off ramps. Pilots limit the maximum size of ships entering the port to 192 m (630 ft) in length. Total tonnage for the fiscal year ending September 1993 was 3,694,034 metric tons (4,071,934 tons), including 158,172 20-ft equivalent units [(1,005,190 metric tons)(1,108,021 tons)] of containerized cargo. The port owns one 228 metric ton (251 km) crawler crane, but containers are either handled by ship's gear or with local stevedoring equipment. Primary commodities handled are containerized general cargo, sugar, molasses, and fuel oil for two local power plants (POPB, 1994; AAPA, 1994; Mets, 1994).

Port of Palm Beach Berths 5-6, 7-11, and Berths 12-17 are operated as public terminals for container handling, general cargo, roll-on/roll-off, cruise lines, and heavy lift cargoes. Berths 5 and 6 have 10.1 m (33 ft) depth alongside and have rail service on the pier, which is owned and operated by the port

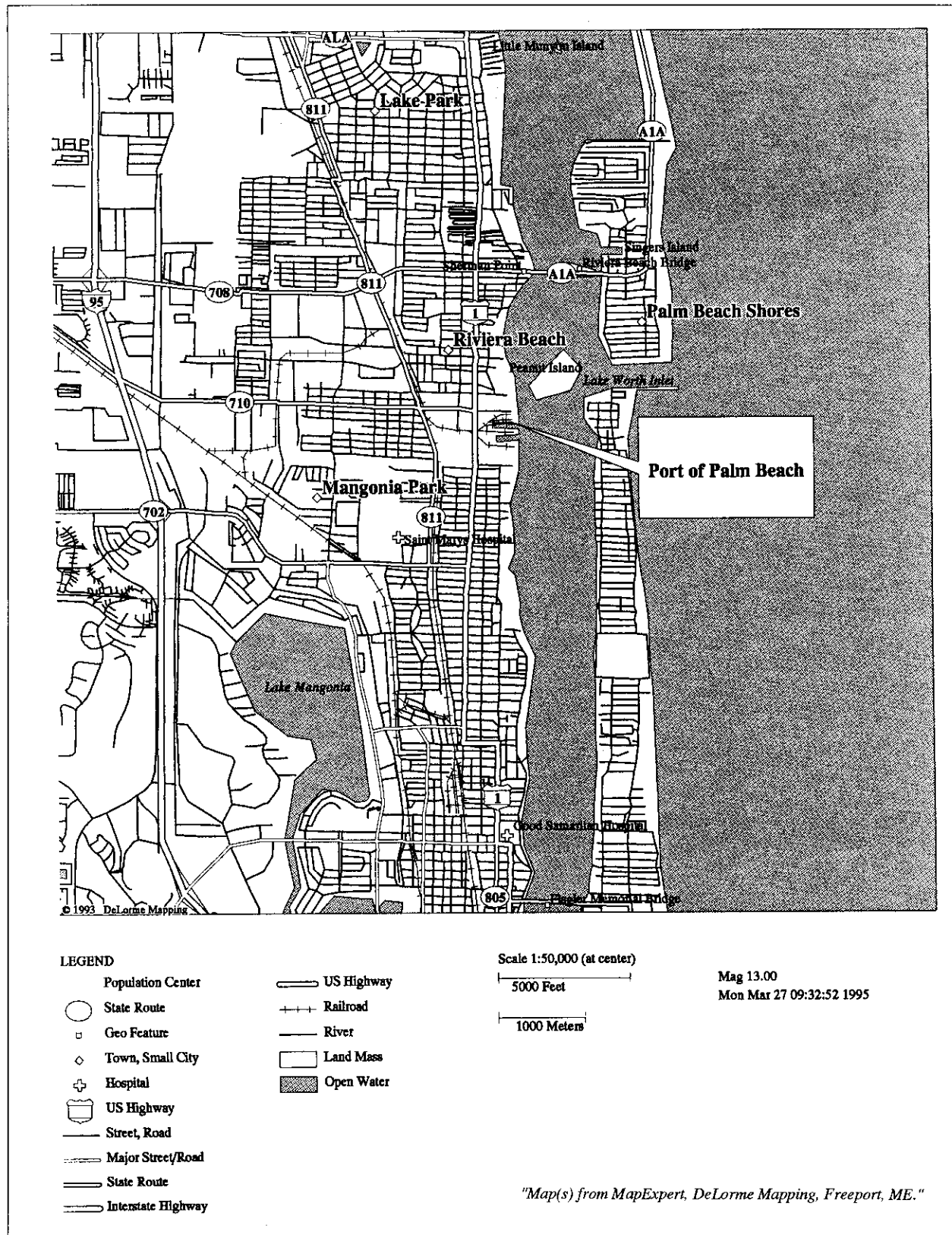


Figure D-47 Map of the Port of Palm Beach, FL

connecting with the Florida East Coast Railroad. The Port of Palm Beach is about 2.4 km (1.5 mi) from I-95 and 8.1 km (5 mi) from the entrance to the Florida Turnpike. The route is through light commercial and residential areas (AAPA, 1994).

Other Pertinent Port Information: Palm Beach has an around-the-clock watchman service, is fenced and lighted and has only one controlled entrance/exit. The port handles explosives and other hazardous goods and according to a port official, the port does not have a prohibition against handling spent nuclear fuel (Mets, 1994). As with other small, multi-use ports, there is some apparent conflict between the handling of petroleum products, cruise ship passengers, and spent nuclear fuel all within the confines of a relatively small, environmentally sensitive harbor complex.

The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Palm Beach, the Uniform Building Code requires buildings to withstand wind speeds up to 160 km/hr (100 mph). The port is located in a very low seismic zone with an acceleration of less than 0.075 g.

Negotiations for the sale of the port's Peanut Island, mentioned above, to the Florida Inland Navigation District are currently underway. Use of the island would be permanently limited to a partial dredge spoil area, as well as habitat preservation, and a passive recreation area (POPB, 1994; Mets, 1994).

The 1990 population of the combined port area (Riviera, Palm, and West Palm Beach) was approximately 115,000, and the average are density was about 650 persons/km² (1,600 persons/mi²). The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are approximately (based on data for nearby Port Everglades): Savannah River Site, 240,000; Oak Ridge Reservation, 350,000; Idaho National Engineering Laboratory, 780,000; Hanford Site, 790,000; and Nevada Test Site, 800,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes for nearby Port Everglades are approximately: Savannah River Site, 1,125 km (700 mi); Oak Ridge Reservation, 1,366 km (850 mi); Idaho National Engineering Laboratory, 4,501 km (2,800 mi); Hanford Site, 5,145 km (3,200 mi); and Nevada Test Site, 4,662 km (2,900 mi). Distances along rail routes are slightly longer.

Climatic and environmental conditions are similar to those reported for Port Everglades in Section D.2.2.18.

D.2.2.17 Philadelphia, PA

Philadelphia, one of the chief ports of the United States, is located at the junction of the Delaware and Schuylkill Rivers, approximately 130 km (81 mi) above the entrance to the Delaware Capes. Access to the port is via the Delaware River through the Delaware Bay. Situated directly across the Delaware River from Philadelphia is Camden, NJ, an important shipping center. The shipping activities of the two cities are closely allied; large quantities of general cargo are handled at the Philadelphia port in both domestic and foreign trade. Access to the port is gained via the Delaware Bay and Delaware River (DOC, 1993c). A map of the port (including Camden, NJ immediately opposite) is shown in Figure D-48.

The Delaware Bay has natural depths of 15.4 m (50 ft) or more for a distance of 8 km (5 mi) from the entrance. A Federal project provides depths of 12.2 m (40 ft) from the sea through the Delaware Bay and River to Philadelphia. There are restrictions on the passage through the Delaware Bay and up the Delaware River, such as a traffic separation scheme established off the entrance to the Delaware Bay.

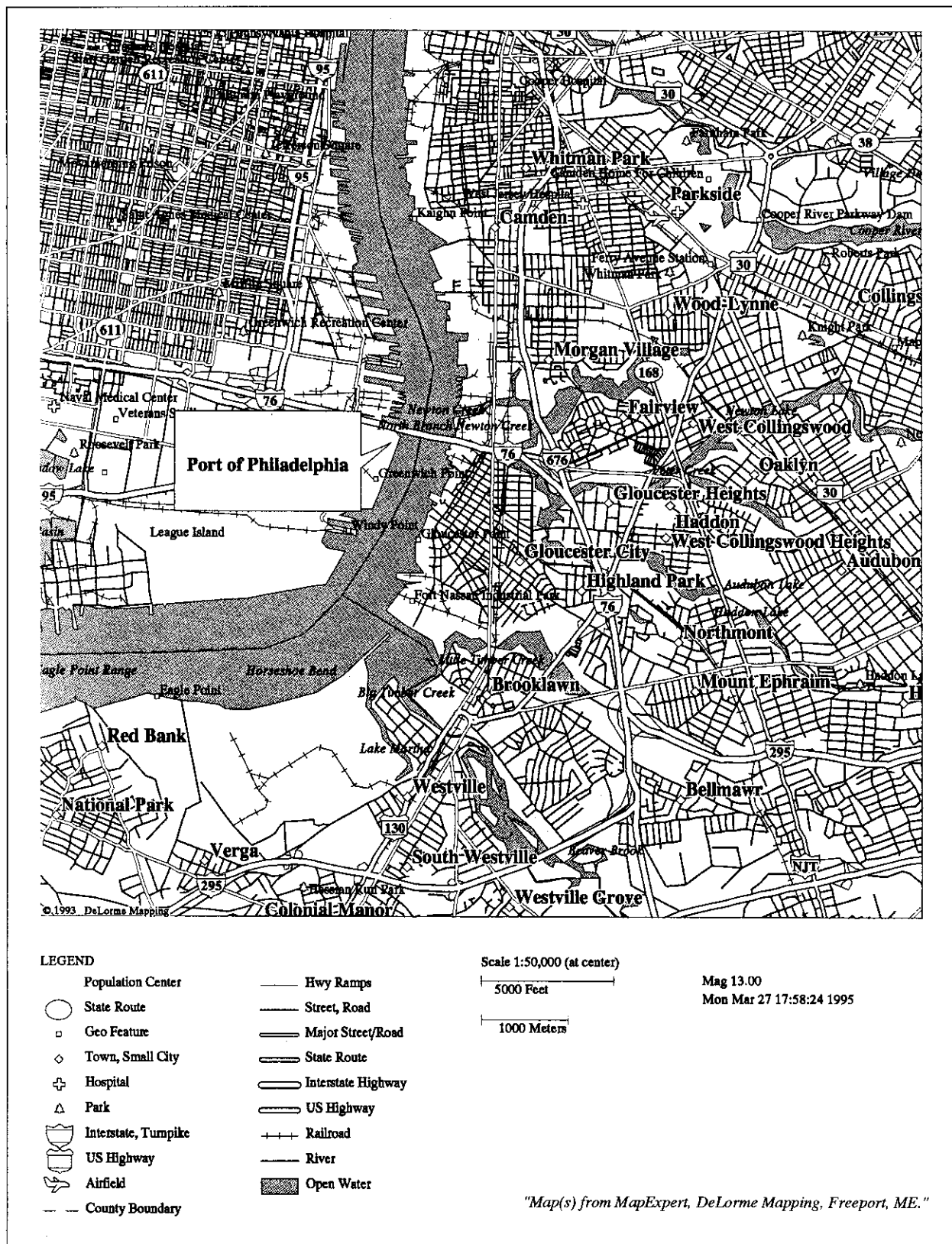


Figure D-48 Map of the Ports of Philadelphia, PA, and Camden, NJ

Ships going to Philadelphia must also pass under the Delaware Memorial Bridge. Roughly 90 percent of the 58,831,000 metric tons (64,849,000 tons) of cargo handled in 1991 were bulk cargo, and a large share of that is known to be crude oil and refinery products (DOC, 1993c; AAPA, 1993).

With the exception of some privately owned terminals, general cargo facilities (including container terminals on the west side of the Delaware River) are owned by the City of Philadelphia. Across the river on the New Jersey side, cargo terminals belong to the South Jersey Port Corporation, a state agency that operates two terminals and leases the remaining ones to private companies. The Philadelphia Regional Port Authority, apparent successor to the Philadelphia Port Corporation, is responsible for City-owned terminals leased to private companies under a landlord-type operation. The Delaware River Port Authority functions as a port planning and economic development division for the facilities controlled by the Philadelphia Regional Port Authority and the South Jersey Port Corporation.

The South Jersey Port Corporation operates two multi-berth terminals, Beckett Street and Broadway. These terminals primarily handle breakbulk general cargoes. Both breakbulk and containers (approximately 4,000 to 5,000 per year) are handled at the Beckett Street terminal during the winter (Castagnola, 1994). Beckett Street terminal has two container cranes, one with a 36.6 metric ton (40 ton) capacity and one with a 77.1 metric ton (85 ton) capacity (Castagnola, 1994). Pier 6, one of the Broadway Berths, is leased to a private company and is equipped with one 72.6 metric ton (80 ton) capacity multi-purpose container crane and one 40.6 metric ton (45 ton) container crane (Jane's, 1992; AAPA, 1993).

Principal container handling facilities owned by Philadelphia Regional Port Authority are the Packer Avenue Terminal, a combination breakbulk/container terminal, and Tioga Container Terminals. The former is located immediately downstream of the Walt Whitman Bridge at the south end of the City's waterfront. The Tioga Terminal is approximately 9.7 km (6 mi) further upstream. Both the Packer Avenue and Tioga Terminals have a depth alongside at mean low water of 12.2 m (40 ft) (Jane's, 1992; AAPA, 1993).

Packer Avenue Terminal: The Packer Terminal is equipped with two 45 metric ton (50 ton) container cranes and one 37.5 metric ton (41 ton) container crane, and has a paved open storage area of 23.5 ha (77 acres). The terminal has 1,184 m (3,885 ft) of marginal wharf (Jane's, 1992; AAPA, 1993).

Tioga Terminal: Tioga has 20.2 ha (50 acres) of paved open storage and is equipped with two 45 metric ton (50 ton) container cranes. The terminal has 796 m (2,612 ft) of marginal container berth; and a 185 m (610 ft) roll-on/roll-off berth.

Both the Packer Avenue and Tioga Terminals are relatively short distances from I-95, which parallels the River and is estimated to be within 0.8 km (0.5 mi) of the container terminals. The Packer Avenue Terminal is served by CSX and Conrail; CSX maintains an intermodal terminal just outside the terminal. On the other hand, the Tioga Terminal has Conrail intermodal service at the terminal. However, neither terminal has ship-side trackage (Jane's, 1992; AAPA, 1993).

A partial list of the diverse liner shipping companies serving these Delaware River terminals include: ABC Container Line, PACE, Atlantik Express Lines, Baltic Shipping Lines, Bangladesh Lines, Barber West Africa, Bottachi, Chilean Line, Columbus, Egyptian National Line, Ellerman, ELMA, Empremer Line, Euro Line, Frota Amazonica, Grandcolumbiana, Hapag-Lloyd, Hoegh, Hyundai, Independent Container Line, Maersk, Netumar, Pakistan National, Shipping Corp of India, SITRAM, Tokai, and Toko (Jane's, 1992).

Other Pertinent Information: The container terminals are fenced with controlled access and 24-hour security. It is not known what arrangements exist for temporary storage of hazardous materials, but it is likely such storage is available in a large port facility (Castagnola, 1993). Spokespersons for the South Jersey Port Corporation (Castagnola, 1993; formerly with the Philadelphia Regional Port Authority) and the Philadelphia Regional Port Authority (Menta, 1993) were unaware of any restrictions on handling spent nuclear fuel, but indicated this was outside their areas of expertise. There are several major oil refineries along the Delaware River below and west of the City of Philadelphia on the Schuylkill River. However, there does not appear to be any serious conflicts in close proximity to the Packer Avenue or Tioga Terminals.

The South Jersey Port Corporation relies on state hazardous materials agencies and the Camden Fire Department for emergency response to the terminals it operates. Private operators are responsible for their own terminals, but basically rely on the fire department. Being a landlord port operator, it is assumed Philadelphia Regional Port Authority terminal operators rely on the Philadelphia Fire Department to respond to hazardous materials incidents. It is not known if there is any hazardous materials training by the Philadelphia Regional Port Authority or the South Jersey Port Corporation (Castagnola, 1993). There are no known special environmental concerns. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Philadelphia, the Uniform Building Code requires buildings to withstand wind speeds up to 120 km/hr (75 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The Philadelphia and Camden waterfronts have become tourist centers due to historical sites and a new aquarium on the Camden waterfront. Veterans Stadium and the Spectrum are located in relatively close proximity to Packer Avenue, as are the Philadelphia Navy Yard and the Philadelphia International Airport.

All terminals in the Greater Philadelphia area are basically located in densely developed and populated industrial/commercial areas. The 1990 population within 16 km (10 mi) of the port terminals (including Camden, NJ) was 1,915,775. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 397,000; Oak Ridge Reservation, 335,000; Idaho National Engineering Laboratory, 513,000; Hanford Site, 622,000; and Nevada Test Site, 756,000. Populations along rail routes to these sites are much larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,190 km (741 mi); Oak Ridge Reservation, 1,090 km (680 mi); Idaho National Engineering Laboratory, 3,950 km (2,452 mi); Hanford Site, 4,610 km (2,868 mi); and Nevada Test Site, 4,220 km (2,623 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The Delaware River at Philadelphia is classified as a low salinity estuarine (generally 0.5 to 5 ppt) and tidal freshwater habitat. Aquatic organisms typically found in the waters of this area include: American shad, Atlantic sturgeon, American eel, blueback herring, shad, alewife, white catfish, brown bullhead, perch, striped bass, bluegill, crappie, pumpkinseed, largemouth bass, carp, and chain pickerel (FWS, 1980f). In addition, the Delaware River is used as a migratory area by the shortnose sturgeon, a Federally listed endangered species. The U.S. Fish and Wildlife Service reported that except for occasional transient species, no federally listed or proposed threatened or endangered species are known to exist in the port's impact area (Perry, 1994).

The Port of Philadelphia is located within Zone 3 (tidal river) of the Delaware River. Protected water used for Zone 3, which encompasses River Mile (RM) 95-108.4, are water supply (agricultural, industry, and public), wildlife, resident fish maintenance, anadromous fish passage, secondary contact, and navigation (DRBC, 1994). However, several uses within Zone 3 are currently impacted, including: 1) fish and other aquatic life due to low dissolved oxygen levels from point source discharges; and 2) fish and shellfish consumption due to chlordane and polychlorinated biphenyl contamination from point and nonpoint source discharges.

Climatic Conditions

The climate of Philadelphia is moderated by the Appalachian Mountains to the west and the Atlantic Ocean to the east. These geographic features cause periods of extreme temperatures to be short-lived in this region (generally, four days). On occasion during the summer months, the area is dominated by maritime tropical air masses, which contribute to elevated local temperature and humidity levels. The average annual precipitation (41.42 in) is relatively evenly distributed throughout the year, with maximum amounts occurring during the late summer months. The summer precipitation regime is dominated by localized thunderstorms and is subject to the influence of the urban heat island effect and local topography, which create varying rainfall amounts across the city for an individual event. Singular snowfall events that generate accumulated totals of greater than 10-in have a 5-year recurrence interval on average. The prevailing wind direction has a bimodal distribution, being southwesterly during summer and northwesterly in the winter months. The annualized average prevailing wind direction is from the west-southwest. Due to Philadelphia's inland location, destructive winds are comparatively rare from tropical cyclones and tornadoes. High winds are generally associated with frontal passages/low pressure systems in winter and thunderstorms in summer months. However, flooding on the Schuylkill River normally occurs twice annually usually associated with strong thunderstorms, with the duration of these events generally lasting less than 12 hrs. The Delaware River is rarely observed at or above flood stage (NOAA, 1992h).

D.2.2.18 Port Everglades, FL

Port Everglades is a major deepwater port located on Florida's southeast coast. It is located immediately off the Atlantic Ocean along the Inland Waterway, within the three cities of Hollywood, Fort Lauderdale, and Dania (DOC, 1993d; D&B, 1993; Southern Shipper, 1993). The major port facilities are immediately inside the harbor entrance, approximately 1.6 km (1 mi) from the south jetty. The approach to Port Everglades is open, and a relatively short 140 m (450 ft)-wide channel leads directly from the Atlantic Ocean to the port facilities. A Federal project provides for depths of 12.8 m (42 ft) to the main port facilities (DOC, 1993d; D&B, 1993; Jane's, 1992; Southern Shipper, 1993; AAPA, 1994; PEA, 1993).

Port Everglades consists of 850 ha (2,100 acres) of land, of which 360 ha (890 acres) are owned by the Port Everglades Authority Commission (Port Everglades Authority). Considerable foreign commerce passes through Port Everglades, in addition to substantial passenger traffic. Many of the world's large passenger vessels call at Port Everglades (it claims to be the world's second-busiest cruise port) (Southern Shipper, 1993). It is a multi-terminal port with more than 3,800 ship calls annually. The port handles over 2,000,000 cruise passengers as well as 17 million tons of cargo, including 1.4 million metric tons (1,600,000 tons) of containerized general cargo (over 100,000 20-ft equivalent units) and over 14 million metric tons (16,000,000 tons) of bulk cargoes (dry/liquid/scrap) in 1991 (FS, 1992). Port Everglades is also a liberty port for the U.S. and North Atlantic Treaty Organization Navies, and is host to facilities operated by the U. S. Naval Surface Warfare Center in Fort Lauderdale. The port is also bordered on the east by a large State Park and seashore recreation area. A map of the port is shown in Figure D-49.

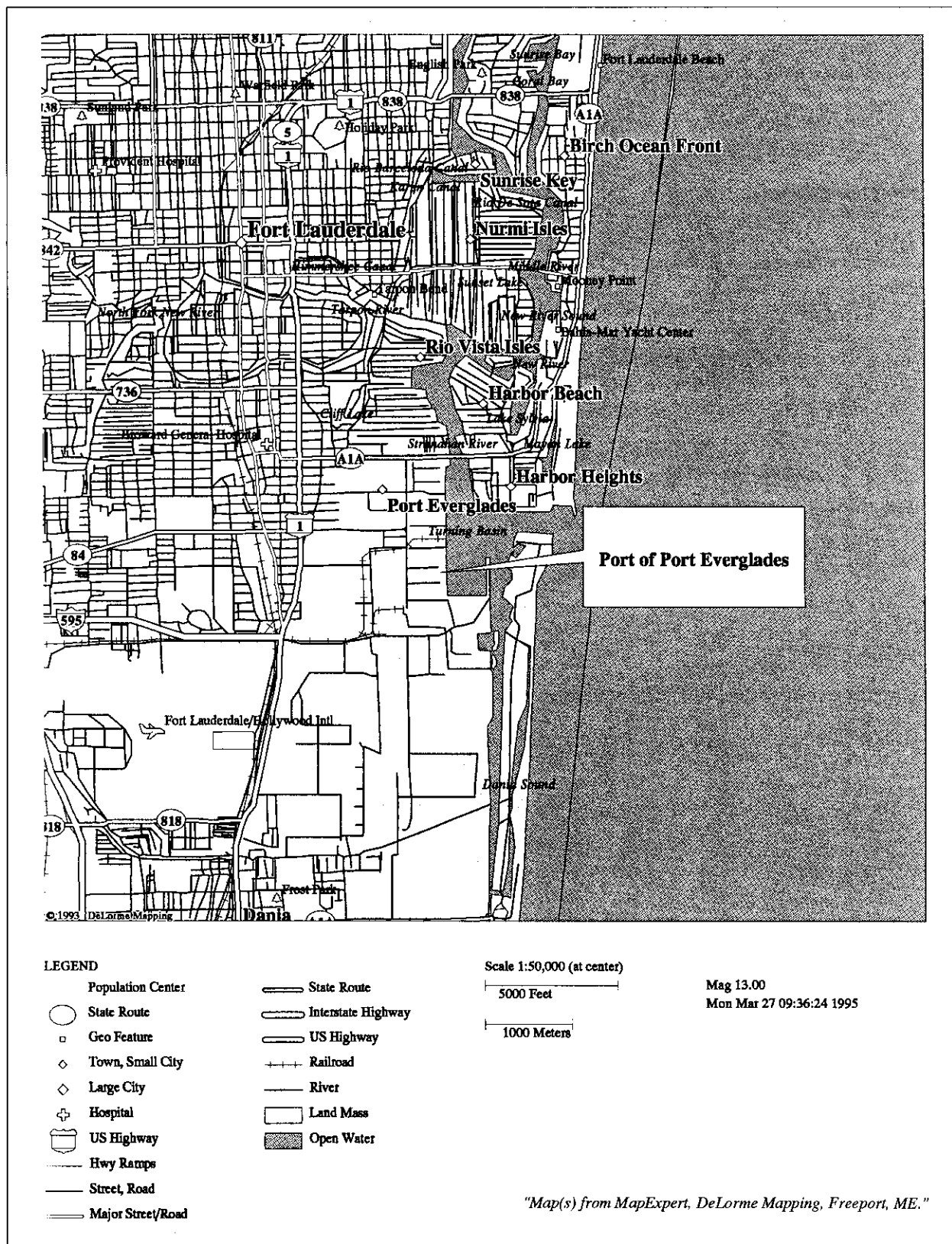


Figure D-49 Map of Port Everglades, FL

The Port Everglades Authority is empowered by the State Legislature to act as the governing entity for the operations, maintenance, and management of port and harbor facilities located within the port's jurisdictional area. The Authority is the governing body responsible for strategic planning and policy setting. In November 1994, governing responsibility for the seaport was transferred to the Broward County Government (PEA, 1993).

Principal container handling facilities at the port include Midport and Southport (there is also a Northport terminal as well).

Midport: Midport has three berths (16, 17, and 18), with three container cranes and 17.8 ha (44 acres) of open storage, and is located just inside the harbor entrance. The berths have a total of 502 m (1,650 ft) of marginal wharf area and depths of 11.6 m (38 ft) alongside at mean low water. Crane capacities at Midport consist of one 50.8 metric ton (56 ton) container crane and two 30.5 metric ton (34 ton) container cranes. Access to Midport is via Port Road, Highway 84, which intersects with U.S. 1, I-95, and all major interstate highways. Highway access appears to be exclusively through port property and/or adjacent industrial-use land. Port-owned trackage is leased to the Florida East Coast Railroad, which maintains an intermodal container yard 1.6 km (1 mi) outside the port on State Road 84. There is trackage to Berth 4, but there does not appear to be any rail lines presently serving the container terminals. There are two roll-on/roll-off ramps at Midport (Jane's, 1992; D&B, 1993; Southern Shipper, 1993; AAPA, 1993 and 1994; PEA, 1993).

Southport: Southport is a new 62.7 ha (155 acre) container/roll-on/roll-off complex at the southern end of Port Everglades Harbor. Southport consists of Berths 31 and 32 with a combined 610 m (2,000 ft) of marginal wharf. Berths 30-33C at Southport have depths of 13.4 m (44 ft) alongside at mean low water. Crane capacities for the berths at Southport include three 40.6 metric ton (45 ton) Post-Panamax container cranes. Access to Southport is via the new Port Everglades Expressway (I-595), which begins just outside the Terminal and connects with I-95, the Florida Turnpike, I-75, and State Highway 84, the cross-Florida Everglades Expressway. Highway access appears to be exclusively through port property and/or adjacent industrial-use land. Southport has a 25.5 ha (63 acre) container yard with storage for up to 5,100 containers on chassis or up to 7,872 grounded and stacked 20-ft equivalent units. There are three roll-on/roll-off ramps at Southport, and an additional three ramps are located at Northport.

Port Everglades is served by over a dozen container and breakbulk Liner Shipping Companies offering sailings to major ports of the world, including South and Central America, Caribbean Islands, North Europe, the United Kingdom, Scandinavia, Spain, the Mediterranean, and the Mid-East. Ship lines include Arawak Caribbean Line, Atlantic Cargo Service, Crowley American Transport, Nedlloyd, Inc., P & O Containers, Ltd., Sea-Land Service, Inc., Tecmarine Lines, and Orient Overseas Container Line.

Other Pertinent Information: Twenty-four-hour security is provided by the Broward Sheriff's Office (BSO). All terminal and container facilities are secured with fencing and controlled gates. The port also has its own 65-member Public Safety Department (fire department), fire fighting equipment and vehicles, and a fireboat for first response to hazardous materials incidents. It is backed up by fire departments from Fort Lauderdale and Hollywood, and Broward County's hazardous materials team. Terminal operators are responsible for their own emergency response arrangements. The Public Safety Department basically functions as an emergency coordinating group. Hazardous materials training is carried out by the municipal agencies responsible for emergency response within the port area. It is not known if the Port Authority itself conducts any training. There appears to be ample space at Southport for temporary storage of hazardous cargoes.

There are no known restrictions to the handling of spent nuclear fuel. However, Item 240 of the Port Everglades Authority Tariff states that explosives, hazardous, or highly flammable commodities or materials may only be handled through special arrangement with the Port Authority. Port Officials indicate that their safety policies, which ban oxidizers such as ammonium nitrate and Class A explosives, would also preclude shipments of spent nuclear fuel. As far as is known, spent nuclear fuel shipments have not been handled by the port (Flint et al., 1993).

Port Everglades is the second-largest petroleum distribution facility in the United States (Southern Shipper, 1993). Major oil companies have more than 86 million barrels of tank space for refined petroleum products inshore of the Midport and Northport terminals. With the possible exception of terminal facilities at Southport, which are remote from the tank farms and other conflicting port users, the potential for conflict between cruise ship operations, tanker traffic, and containerized spent nuclear fuel shipments appears to be great.

Southport Terminal is the preferred terminal, as it is relatively remote from the City of Fort Lauderdale, has direct connection to the Interstate Highway system, and is located in a nonresidential port industrial district. The physical layout and constraints of port waterways, however, combined with its intense use by potentially conflicting types of transport (i.e., cruise ships, tankers and tank barges, container and breakbulk vessels, and recreational traffic, plus a State seashore park on its eastern boundary) detracts from its otherwise superb facilities.

The port is subject to severe hurricanes and tropical storms. The likelihood of severe natural phenomena such as high winds and earthquakes is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For Port of Everglades, the Uniform Building Code requires buildings to withstand wind speeds up to 150 km/hr (95 mph). Port Everglades is located in a very low seismic zone with an acceleration of 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 714,176. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the 5 potential DOE management sites are: Savannah River Site, 244,000; Oak Ridge Reservation, 352,000; Idaho National Engineering Laboratory, 754,000; Hanford Site, 803,000; and Nevada Test Site, 817,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,170 km (726 mi); Oak Ridge Reservation, 1,420 km (884 mi); Idaho National Engineering Laboratory, 4,540 km (2,820 mi); Hanford Site, 5,210 km (3,236 mi); and Nevada Test Site, 4,700 km (2,923 mi). Distances along rail routes are slightly longer.

Environmental Conditions

The State of Florida has classified the waters surrounding Port Everglades as Class III. This classification indicates that the waters are suitable for recreation, and propagation and maintenance of a healthy, well balanced population of fish and wildlife (FL DEP, 1994). As previously noted, Outstanding Florida Waters are generally waters located within national parks, state parks, national seashores, marine sanctuaries, or aquatic preserves. Waters located near Port Everglades designated as Outstanding Florida Waters include the waters within the John U. Lloyd Beach State Recreation Area, West Lake, Snake Warrior Island, North Beach, and the Hugh Taylor Birch State Recreation Area (FL DEP, 1994). These waterways are afforded special protection by the State environmental regulations.

The waters surrounding Port Everglades are characterized as high salinity estuarine habitats (generally greater than 20 parts per thousand). Aquatic species of interest in the vicinity of Port Everglades include: crabs, shrimp, lobster, seatrout, croaker, tarpon, sheepshead, spot, kingfish, drum, silver perch, bluefish, mullet, pompano, pinfish, pigfish, Crevalle jack, grunt, ladyfish, permit, grouper, snapper, jewfish, snook, striped mojarra, and Atlantic bottlenose dolphin (FWS, 1982b).

The John U. Lloyd Beach State Recreation Area is located approximately 4 km (2.5 mi) south of Port Everglades. Additional special land use areas located near Port Everglades are Everglades Wildlife Management Area and Hugh Taylor Birch State Recreation Area. Protected animal species in the Port Everglades vicinity include: the West Indian manatee, loggerhead sea turtle, green sea turtle, and the least tern. Protected plant species in the area are the coontis, sea lavender, and the silver palm (FWS, 1982b).

Port Everglades has several ongoing environmental programs, including the creation of a Manatee Refuge and "Nursery" area within the confines of the port, a wetlands program, and a 22.3 ha (55 acre) permanent mangrove forest and manatee reserve deeded to the Florida Department of Environmental Regulation. The port was awarded the 1991 National American Association of Port Authorities Environmental Award of Excellence (PEA, 1993). The U.S. Fish and Wildlife Service reported that the Port Everglades Midport Terminal is located in designated critical habitat for the manatee (Johnson, 1995).

Climatic Conditions

The climate of this region is essentially subtropical marine, featuring long, warm summers with abundant rainfall, generally followed by a mild, dry winter. The influence of the ocean is seen in the small diurnal temperature range (generally less than 10 degrees) and the rapid warming of any cold air masses that invade this portion of the State. The predominant windflow is from the east-southeast, which generates conditions right at the coast that are often different than those encountered further inland, due to land-induced frictional effects. Hurricanes occasionally affect the area, with the months of September and October exhibiting the highest frequencies. However, destructive tornadoes (not associated with tropical systems) are rare. Waterspouts are frequently spotted offshore during the summer months, but rarely cause any loss of life or property damage (NOAA, 1993b).

D.2.2.19 Richmond, VA

The Port of Richmond Terminal is located on the left ascending bank of the James River, approximately 140 km (89 mi) above the City of Newport News. The port is owned by the City of Richmond and operated by Mecham Overseas Terminal, Ltd. A map of the port is provided in Figure D-50.

Drafts of vessels using the river above Newport News generally do not exceed 4.5 m (15 ft). Vessels drawing more than 7.5 m (24 ft) do navigate it occasionally, but the Virginia Pilots Association restricts ship drafts to 6.7 m (22 ft). A Federal Project provides for dredging depths of 7.6 m (25 ft) to the Richmond Terminals. Numerous stakes, pilings, wrecks and other obstructions are on both sides of the main channel. Travel on the upper river is restricted to daytime hours for ships more than 77.7 m (255 ft) in length (DOC, 1993c). For FY 1993-94, the Terminal handled a total of 445,700 metric tons (491,300 tons) including 313,540 metric tons (345,620 tons) of containerized cargoes (41,286 20-ft equivalent units), and 114,890 metric tons of breakbulk freight (AAPA, 1994; PORT, 1994). Major shipping lines connect the port with the Mediterranean, North Europe, South America, the Middle East, and India (PORT, 1994).

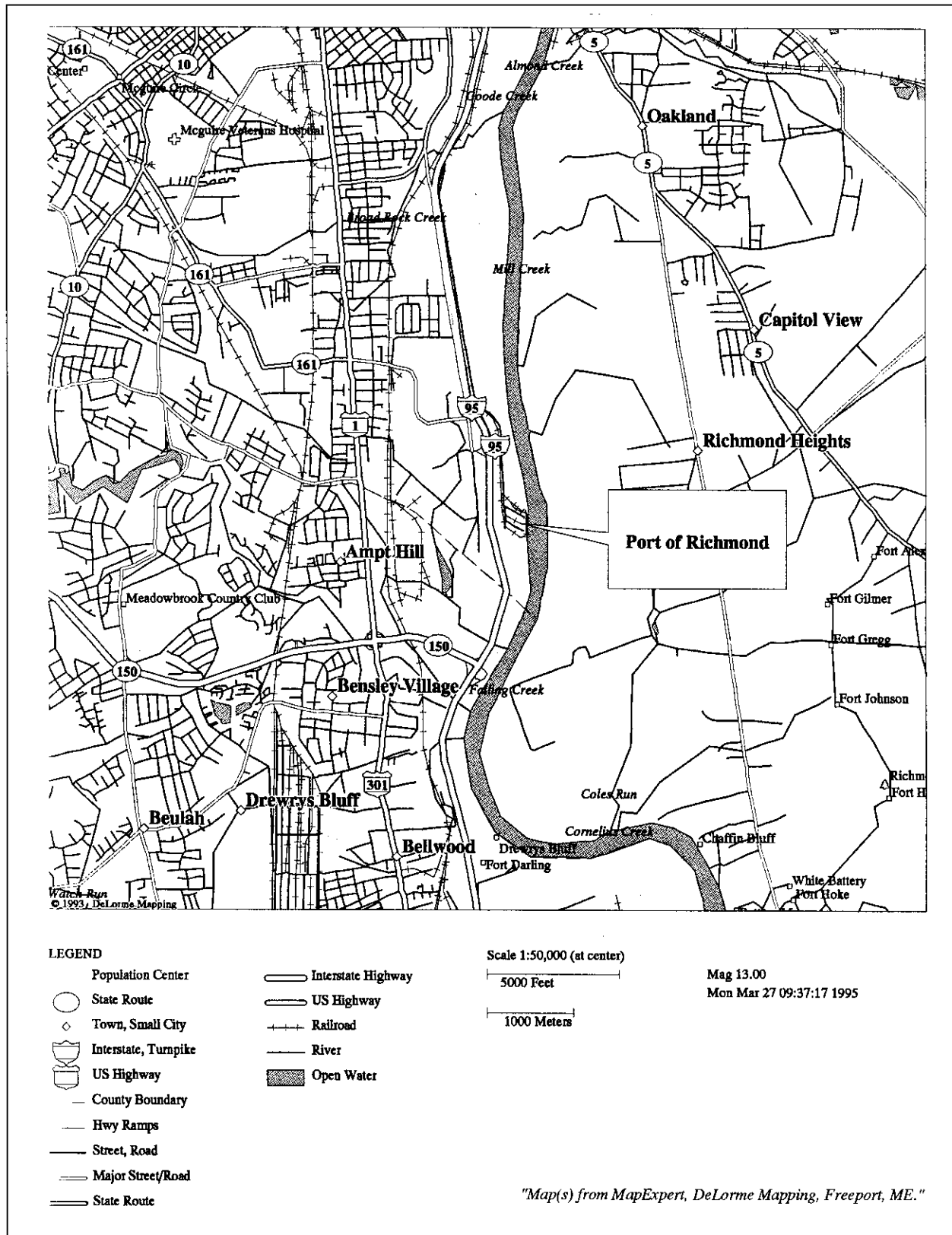


Figure D-50 Map of the Port of Richmond, VA

Richmond Terminal has two marginal berths with a total length of 381 m (1,250 ft) and 7.6 m (25 ft) of water alongside at mean low water. CSX Railroad tracks with multiple sidings serve the port's two warehouses and container storage yards. The Terminal is a container, general cargo, and breakbulk handling facility with roll-on/roll-off vessel and container and trailer on flatcar capabilities. The port has two 209 metric ton (230 ton) and one 319 metric ton (350 ton) capacity crawler cranes outfitted with 22.9 m (75 ft) booms. A new 273 metric ton (300 ton) crane was purchased in April 1994 and set a new accident-free container handling record of 20.43 20-ft equivalent units/hr (PORT, 1994).

The port is about 1.6 km (1 mi) from highway I-95 with travel through an industrial area. It is also served by a trunk railway.

Other Pertinent Port Information: The Port of Richmond has only one entrance which is controlled by a Pinkerton Guard on a 24-hour basis.

The Port of Richmond Terminal is in the midst of an \$8-10 million expansion program involving a 96 m (315 ft) wharf extension, new gate entrance and maintenance building, plus upgraded container storage areas (PORT, 1994).

The likelihood of severe natural phenomena such as high winds and earthquakes are reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Richmond, the Uniform Building Code requires buildings to withstand wind speeds up to 120 km/hr (75 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The 1990 Census city population was approximately 203,000 and the population density was about 1,304 per km² (3,376 per mi²). The distances to the five management sites on interstate routes are: Savannah River Site, 732 km (455 mi); Oak Ridge Reservation, 784 km (487 mi); Idaho National Engineering Laboratory, 3,900 km (2,426 mi); Hanford Site, 4,570 km (2,842 mi); and Nevada Test Site, 4,070 km (2,529 mi). Distances along rail routes are slightly longer.

Climatic Conditions

Richmond's climate might be classified as modified continental. Summers are warm and humid and winters generally mild. The mountains to the west act as a partial barrier to outbreaks of cold, continental air in winter, the coldest air being delayed long enough to be modified, then further warmed as it subsides in its approach to Richmond. The open waters of the Chesapeake Bay and Atlantic Ocean contribute to the humid summers and mild winters. The coldest weather normally occurs in later December and in January, when low temperatures usually average in the upper twenties and the high temperatures in the upper forties. Temperatures seldom lower to zero.

Precipitation is rather uniformly distributed throughout the year. However, dry periods lasting several weeks do occur, especially in autumn when long periods of pleasant, mild weather are most common. There is considerable variability in total monthly amounts from year to year so that no one month can be depended upon to be normal. Snow has been recorded during seven of the 12 months. Snowfalls of 10 cm (4 in) or more occur on an average of once a year. Snow usually remains on the ground only one or two days at a time. Ice storms (freezing rain or glaze) are not uncommon in winter, but they are seldom severe enough to do any considerable damage. The James River reaches tidewater at Richmond, where flooding has occurred in every month of the year, most frequently in March (28 times in the past 61 years), and only twice in July. Hurricanes and less severe storms of tropical origin have been responsible for most of the

flooding during the summer and early fall. Damaging storms occur mainly from snow and freezing rain in winter, and from hurricanes, tornadoes, and severe thunderstorms in other seasons. Damage may be from wind, flooding, or rain, or from any combination of these (DOC, 1993c).

D.2.2.20 San Francisco, CA

San Francisco, CA, occupies the north portion of the peninsula forming the south entrance to San Francisco Bay. The Port of San Francisco, one of the largest ports on the bay, is the oldest and one of the most important on the Pacific Coast (DOC, 1992b).

San Francisco is a deepwater port stretching approximately 12 km (7.5 mi) along the southern and western shore of the San Francisco Bay. The approach to San Francisco and down the east side of San Francisco is open; however, there are restricted navigational areas. There is also considerable traffic in the bay area, and there is a traffic separation scheme under U.S. Coast Guard traffic control (Mitchell, 1994). Depths of 13.7 m (45 ft), or more, are available from the Golden Gate Bridge to most of the anchorages. Depths up to 12.2 m (40 ft) are available to most piers, including those at the container facilities in the vicinity of Islais Creek. The wide passage from the ocean to San Francisco Bay is reduced to approximately 1.13 km (0.7 mi) at the Golden Gate Bridge pier. The distance from the Golden Gate Bridge to the entrance of facilities near Islais Creek is approximately 19 km (12 mi) (DOC, 1992b). A map of the port is shown in Figure D-51.

The Port of San Francisco is under the control of the City and County of San Francisco, to which it was transferred by the State in 1969. The "authority" reports to an appointed board of Harbor Commissioners. The port is a multi-terminal, multi-function harbor complex that the Authority operates as a Landlord owner. Services of the port range from cargo handling along the southern waterfront to ferry terminals and tourism services — including a cruise ship terminal, ferry plaza, Embarcadero, excursion boat terminals, Fisherman's Wharf, and aquatic park located on the central, northern, and western sides of the port (POSF, 1993).

Principal container handling facilities are located at North Terminal (Pier 80), operated by Metropolitan Stevedore Co., and South Terminal (Piers 94-96) operated by Stevedoring Services of America. Breakbulk general cargo is handled at Piers 27 - 29 in the northern Embarcadero section of the city. Total tonnage handled in calendar year 1991 amounted to 5,994,000 metric tons (6,607,200 tons) and included 223,676 20-ft equivalent units of containerized cargo (AAPA, 1993). With the 1994 loss of four major container lines to Oakland and the closing of the Naval Supply Center, the Port's Chief Wharfinger expected container traffic for the year to drop to about 50,000 20-ft equivalent units (Mitchell, 1994).

South Container Terminal: This terminal has a total area of 30.6 ha (75.6 acres), one container freight station, and four gantry-type container cranes. Dock/quay lengths for cargo ships at South Terminal are three berths totalling 747 m (2,450 ft) in length. Depths alongside dock/quay are 12.19 m (40 ft) at mean low water. North Terminal has three 40.6 metric ton (45 ton) rail-mounted container cranes and two 30.5 metric ton (34 ton) rail-mounted container cranes (Jane's, 1992; AAPA, 1993).

North Container Terminal: This terminal has a square-shaped, finger-type pier comprised of 27.74 ha (68.6 acres), of which 13 ha (32.1 acres) are laid out for container operations. This terminal has five container cranes and its own CFS. Dock/Quay lengths for cargo ships at this terminal are four berths at a total length of 1,552 m (5,092 ft). Depths alongside dock/quay are 12.2 m (40 ft) at mean low water. Crane capacities at South Terminal include four 30.5 metric ton (34 ton) rail-mounted container cranes (Jane's, 1992; AAPA, 1993; Mitchell, 1994).

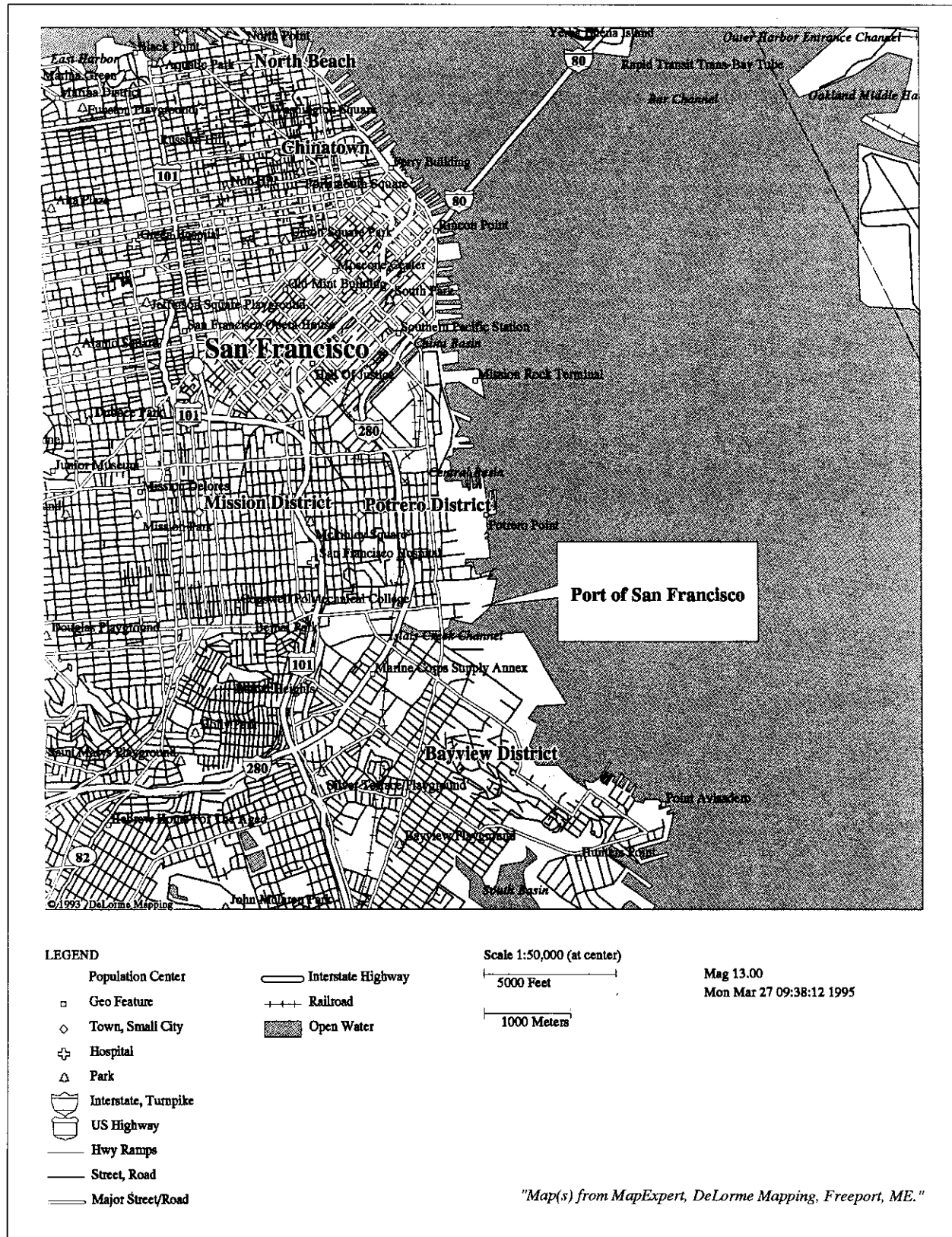


Figure D-51 Map of the Port of San Francisco, CA

Truck access to the container terminals is via Cargo Way and Third Street. Cargo Way connects South Terminal Piers 94 - 96 with 3rd Street. Entrance to the North Container Terminal (Pier 80) is at the intersection of 3rd Street and Army Street, which connects with I-280 and U.S. Highway 101 about 0.8 km (0.5 mi) from the entrance and about 1.6 km (1 mi) from the entrance to the South Container Terminal. These highways link up with the San Francisco/Oakland Bay Bridge (I-80) — the assumed route to Idaho National Engineering Laboratory and/or points east— which is roughly 1.6 to 2.4 km (1 to 1.5 mi) away. The Southern Pacific Railway serves both the North and South Container Terminals, and the Union Pacific also has tracks to the North Terminal's Pier 80. Trackage at South Terminal extends shipside parallel to the berth. Adjacent to the South Container Terminal is a 14.6 ha (36 acre) intermodal container transfer facility (Jane's, 1993; AAPA, 1993).

San Francisco has been served by a number of major container carriers. Lines calling at South Terminal include Grancolombiana and Evergreen. Liner companies using North Terminal include Blue Star Line, Central American Container Line, CSAV (Chilean Line), ELMA, Nedlloyd, NSCP, South Seas Shipping, and Splosna Plovba (Jane's, 1992; AAPA, 1993). However, in 1994, four of its five major container lines moved to Oakland (Adams, 1994; Mitchell, 1994).

Other Pertinent Information: Terminal security is the responsibility of the respective terminal operating companies. Facilities are fenced with controlled access and are patrolled by watchmen supplied by the International Longshoremen Workers Union. There are also City police officers permanently assigned for general port security (Mitchell, 1994). There are places within the container terminals for temporary segregation and storage of hazardous materials (Mitchell, 1993).

There are no regulations prohibiting the handling of containerized spent nuclear fuel. The port handles hazardous cargoes but, as far as known, has not handled spent nuclear fuel. The port allows Class A and B explosives in small amounts only (Mitchell, 1994).

All of San Francisco's marine terminals are located within the densely populated downtown area of the city and the large tourist population. Although there appears to be conflicting use of the Port of San Francisco's marine facilities (primarily attributable to its tourism business, much of which is centered to the north and west of the port's two container terminals) it is not deemed a major consideration. Terminal operators are responsible for accidents within their respective facilities. The Port Authority relies on the City of San Francisco's Fire Department hazardous materials team and the Coast Guard in case of an emergency. The City of San Francisco has a special Engine Company for responding to fires and other dangerous situations within port facilities, with about a five minute response time (Mitchell, 1993 and 1994). The Pacific Maritime Association handles hazardous materials instruction and training, and has just begun a program at the port (Mitchell, 1993). It is noted that U.S. Coast Guard statistics indicate that terminals in the San Francisco Bay have had only 31 reported collisions reported but an unusually high number of fires in recent years (21 fires reported between 1991 and 1993; the worst three-year fire record for major ports on the West Coast) (USCG, 1994b).

There are no known protected habitats or sanctuaries immediately near the terminals that might be affected by an accident in port. However, the predisposition of the City to severe earthquakes, and the high sensitivity of this area to protecting and maintaining environmental quality is considered a basis for concern. The city rests on the edge of the Pacific tectonic plate, while the opposite side of the Bay sits on the Continental plate. This results in the entire Bay area being a highly seismic zone. On April 18, 1906, San Francisco was the site of one of the largest recorded earthquakes in the contiguous United States, a Modified Mercalli Intensity XI (Bolt, 1978) due to movement along the fault line separating the two tectonic plates. The Uniform Building Code requires construction to withstand earthquakes and other severe natural phenomena (UBC, 1991). The Uniform Building Code requires construction for an

acceleration of 0.40 g, the highest seismic ranking in the United States. High winds have not been a problem for the Bay, with a Uniform Building Code minimum basic wind speeds up to 140 km/hr [70 miles per hour (mph)].

The climatic and environmental conditions of the Port of San Francisco are the same as those reported for the Port of Oakland in Section D.2.2.15.

The 1990 population within 16 km (10 mi) of the port terminals was 1,265,529. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 1,060,000; Oak Ridge Reservation, 766,000; Idaho National Engineering Laboratory, 348,000; Hanford Site, 339,000; and Nevada Test Site, 461,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 4,570 km (2,803 mi); Oak Ridge Reservation, 4,130 m (2,567 mi); Idaho National Engineering Laboratory, 1,560 m (970 mi); Hanford Site, 1,420 km (882 mi); and Nevada Test Site, 1,160 km (722 mi). Distances along rail routes are slightly longer.

D.2.2.21 Seattle, WA

The Port of Seattle, WA, is located 230 km (143 mi) from the confluence of the Strait of Juan de Fuca and the Pacific Ocean. Seattle is located on Elliott Bay on the eastern shore of the Puget Sound, about 93 km (50 mi) south of the Strait of Juan de Fuca and about 5 km (3 mi) from the Sound. It is the largest and most important city in the Northwest, and one of the major ports on the Pacific Coast. Access from the Pacific Ocean is gained through the Strait of Juan de Fuca and Puget Sound. The transit from the Pacific Ocean to Seattle is open and considered relatively easy, with very deep waters during the entire approach to Seattle (DOC, 1992b). A map of the port is shown in Figure D-52.

The Port of Seattle is a large, diversified, multi-terminal port. Overall container tonnage for 1992 amounted to 7,510,000 metric tons (8,278,300 tons) and 1,155,000 20-ft equivalent units. It is managed by the Managing Director of the Marine Division and staff. Its facilities are municipally owned and leased to tenants (i.e., the Port Authority operates as a Landlord owner) (POS, 1994).

The port has five container terminals, of which two, Terminals 5 and 18, are considered public facilities:

Terminal 5: T5 is located on the West Waterway and is leased to and operated by American President Lines. Terminal 5 has a total area of 36 ha (89 acres), of which 24 ha (59 acres) can be used for container handling and storage. It has three container berths (Berths 4, 5, and 6), is equipped with six 50.8 metric ton (56 ton) Post-Panamax container cranes, and has two container freight stations. Terminal 5 has 760 m (2,500 ft) of marginal wharf, with 12.19 m (40 ft) of water alongside at mean low water. The terminal has good access to Interstate 5; about 3.8 km (2.4 mi) from the ramp to I-5 following a route entirely within the port's industrial district via North Marginal Way and West Seattle Freeway to South Spokane Street. I-5 is the principal north/south roadway linking Seattle with I-84 at Portland, OR (the assumed preferred, year-around route to Idaho National Engineering Laboratory) and/or I-90/82, which also links up with I-84 near Pendleton, OR. Terminal 5 is served by the Burlington Northern Railroad, whose tracks are located at the rear of the Terminal. The port is considering a proposal to provide Union Pacific service (Benham et al., 1994). Terminal 5 is served by major container lines including APL, OOCL, Star Shipping, and Westwood Shipping (Jane's, 1992; AAPA, 1993; D&B, 1993).

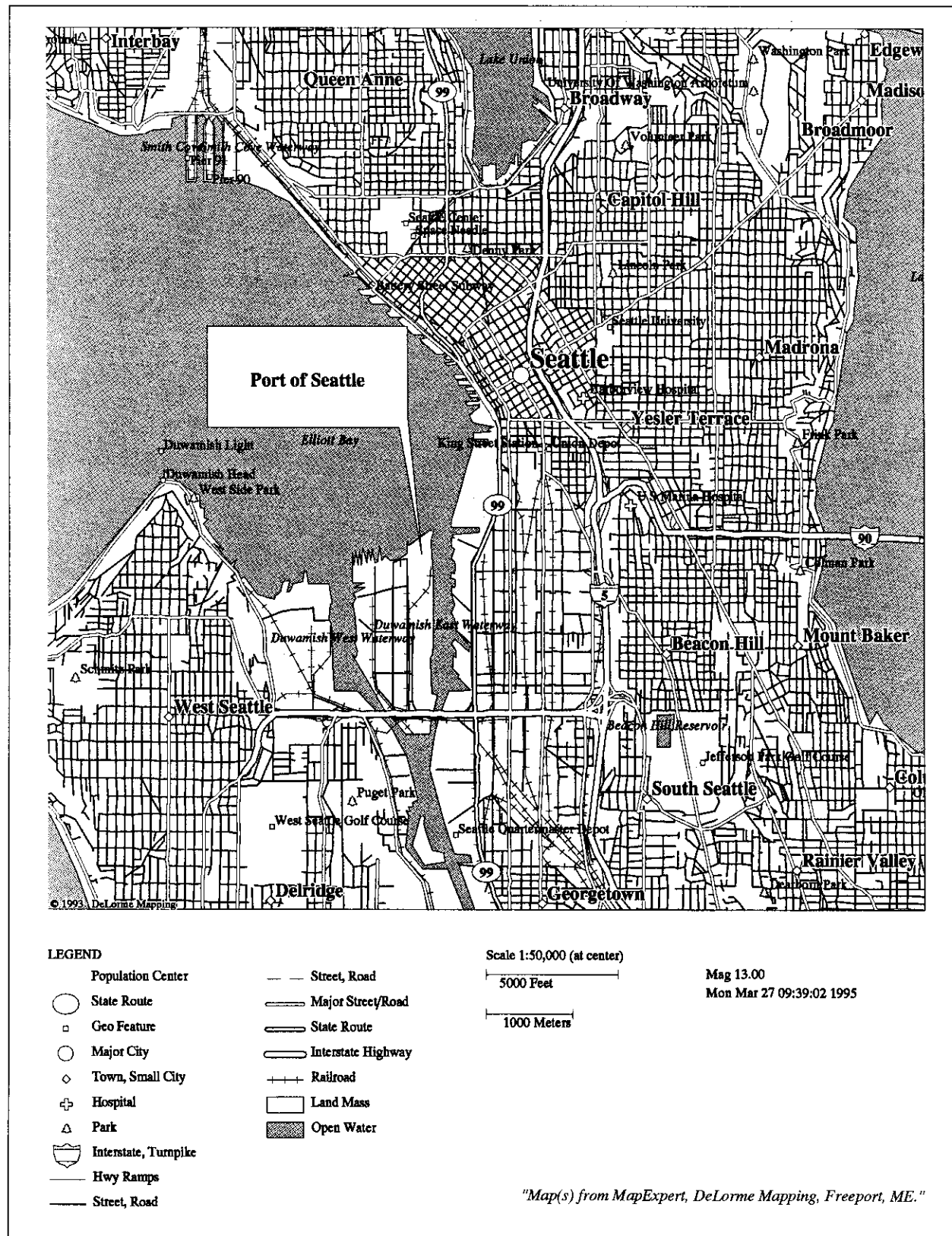


Figure D-52 Map of the Port of Seattle, WA

Terminal 18: T18 is located on the East Waterway (Berths 1 - 4, and 5 - 8), is operated by Stevedoring Services of America, and has a total area of 47 ha (116 acres) devoted to container handling and storage. It is also equipped with six, 40.6 metric ton (45 ton) container cranes and container freight stations. Terminal 18 has 1,844 m (6,049 ft) of marginal wharf, with 15.24 m (50 ft) of water alongside at mean low water. The terminal also has good access to Interstate 5; about 2.9 km (1.8 mi) from the ramp to I-5 following a route that is also entirely within the port's industrial district via South Spokane Street. Terminal 18 is also served by the Burlington Northern as well as the Union Pacific railroads via tracks along the wharf apron (i.e., ship-side).

Terminal 18 is served by several major container lines, including Barber Blue Sea, Grancolombiana Line, COSCO, d'Amico Line, Japan Line, Hyundai, Scindia Line, Chilean Line, ACL/CGM, and P&O Container Line (Jane's, 1992; AAPA, 1993; D&B, 1993; Benham et al., 1994).

Other Pertinent Information: There are potentially conflicting activities near the Terminal; petroleum products are pumped ashore at Terminal 5 (Berths 4 and 5), and across the East Waterway at Terminal 18 (Berths 2 and 3). The terminals are fenced with controlled access and guarded by watchmen on a 24-hour basis. There are areas within the container terminals for segregating hazardous materials cargoes.

The port's Emergency Response Plan relies on the City of Seattle Fire Department for hazardous materials response, with a technical support team including spent nuclear fuel handling experts from the DOE Hanford Site hazardous materials training for port workers is the responsibility of the individual terminal operators (Benham and Schuler, 1993; Benham et al., 1994). As noted in the accident information for Tacoma, the overall ship accident rates in the Puget Sound for the 1991-1993 reporting period are relatively low (USCG, 1994b).

Seattle's container terminals are somewhat separated from the City, which is generally north-east of the terminals. As already noted, these terminals have good access to Interstate highways without passing through congested city streets. However, T5 and T18 are both relatively close to some residential areas in West Seattle.

According to Mr. Schuler, Port Safety Officer, a port Commission resolution banning spent nuclear fuel shipments from the Port of Seattle has been in place for 3 or 4 years (Benham and Schuler, 1993). Reportedly, the Commissioners felt the Federal government was unresponsive to their requests for information concerning material being shipped and decided to ban further spent nuclear fuel shipment. As a result, the port no longer handles spent nuclear fuel and does not want it passing through its facilities. Since discussing this issue with the port safety official, DOE was informed that the Seattle City Council passed a resolution on December 8, 1993, which states the City's position that "high-level nuclear wastes should not be moved through Seattle or the Puget Sound by water or land transportation" (Noland, 1994). This issue is addressed in Section 6.5 of the EIS. Port officials (Benham and Schuler, 1993) thought the port had some prior experience with handling spent nuclear fuel, but this was not confirmed by available data going back to 1979 (NRC, 1993; SNL, 1994).

There are no known particularly environmentally sensitive areas (e.g., such as wildlife sanctuaries) in the immediate area of the terminals, but there is extreme public environmental sensitivity to potential environmental damage to the Puget Sound area.

The entire Puget Sound area is subject to severe earthquakes and volcanism. There have been two major earthquakes in the Puget Sound area this century; a Modified Mercalli Intensity VIII on April 13, 1949 and a Modified Mercalli Intensity VII-VIII on April 29, 1965 (Bott, 1978). On May 18, 1982, Mount Saint Helens suffered a major volcanic eruption (IPA, 1993). All the mountains along the Cascades Range,

from Canada to Northern California, are volcanic in origin and are potentially active (Foster, 1971; Hamilton, 1976; IPA, 1993). The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Seattle, the Uniform Building Code requires buildings to withstand wind speeds up to 130 km/hr (80 mph). The port is located in a high seismic zone with an acceleration of 0.30 g.

The 1990 population within 16 km (10 mi) of the port terminals was 753,296. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 565,000; Oak Ridge Reservation, 395,000; Idaho National Engineering Laboratory, 122,000; Hanford Site, 62,900; and Nevada Test Site, 344,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Figures D-8 through D-17 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 4,670 km (2,900 mi); Oak Ridge Reservation, 4,240 km (2,636 mi); Idaho National Engineering Laboratory, 1,280 km (793 mi); Hanford Site, 360 km (226 mi); and Nevada Test Site, 2,130 km (1,322 mi). Distances along rail routes are slightly longer.

Environmental Conditions

A variety of aquatic species can be found in Puget Sound. Several animal species with special status may also be found in this area. A variety of marine mammals can be found in the central Puget Sound, including the Pacific harbor seal, California sea lion, killer whale, Dall porpoise, and harbor porpoise. In 1991, the U.S. National Marine Fisheries Services reported that the following endangered and/or threatened species may occur in the Puget Sound: the endangered gray whale, the endangered humpback whale, the threatened Stellar sea lion, and the endangered leatherback sea turtle (DOE, 1995). These species are not reported at the port. The U.S. Fish and Wildlife Service reported that the bald eagle and marbled murrelet, both listed protected species, may occur in the vicinity of the port (Frederick, 1994). Bald Eagles can be found throughout this coastal zone and American peregrine falcons are uncommon winter visitors (FWS, 1981a). The FWS's Ecological Inventory for the Puget Sound area indicates that the habitat of Elliott Bay is used by a variety of birds, including: shorebirds, gulls, sandpipers, turnstones, plovers, yellowlegs, herons, rails, great blue heron, waterfowl, loons, grebes, swans, geese, dabbling ducks, diving ducks, mergansers, American widgeon, pintail, mallard, seabirds, cormorants, alcids, common murre, and the pigeon guillemot. Adult concentrations of all of these species may be found in the Bay. Some of these species may also use this area as an overwintering area, a migratory area, and/or a nesting area (FWS, 1981a). It is also indicated that adult concentrations of Chinook salmon, coho salmon, and chum salmon are found in the West Waterway and Duwamish Waterway and use these water bodies and upstream segments as migratory and nursery areas.

According to the State of Washington's Department of Wildlife, the California sea lion uses the waters in the vicinity of Harbor Island as "haulouts" (i.e., areas regularly used by marine mammals for resting). Several seabird colonies also exist in this general area. There is a general lack of wetlands along the southeastern shore of Elliott Bay and along the East and West Waterways and the Duwamish Waterway (WDW, 1994a).

Climatic Conditions

The Strait of Juan de Fuca separates the northern coast of the State of Washington and the southern shore of Vancouver Island, Canada. Also in this general vicinity is the Port of Tacoma, Washington which is located 263 km (142 nautical mi) from the confluence of the ocean and the strait.

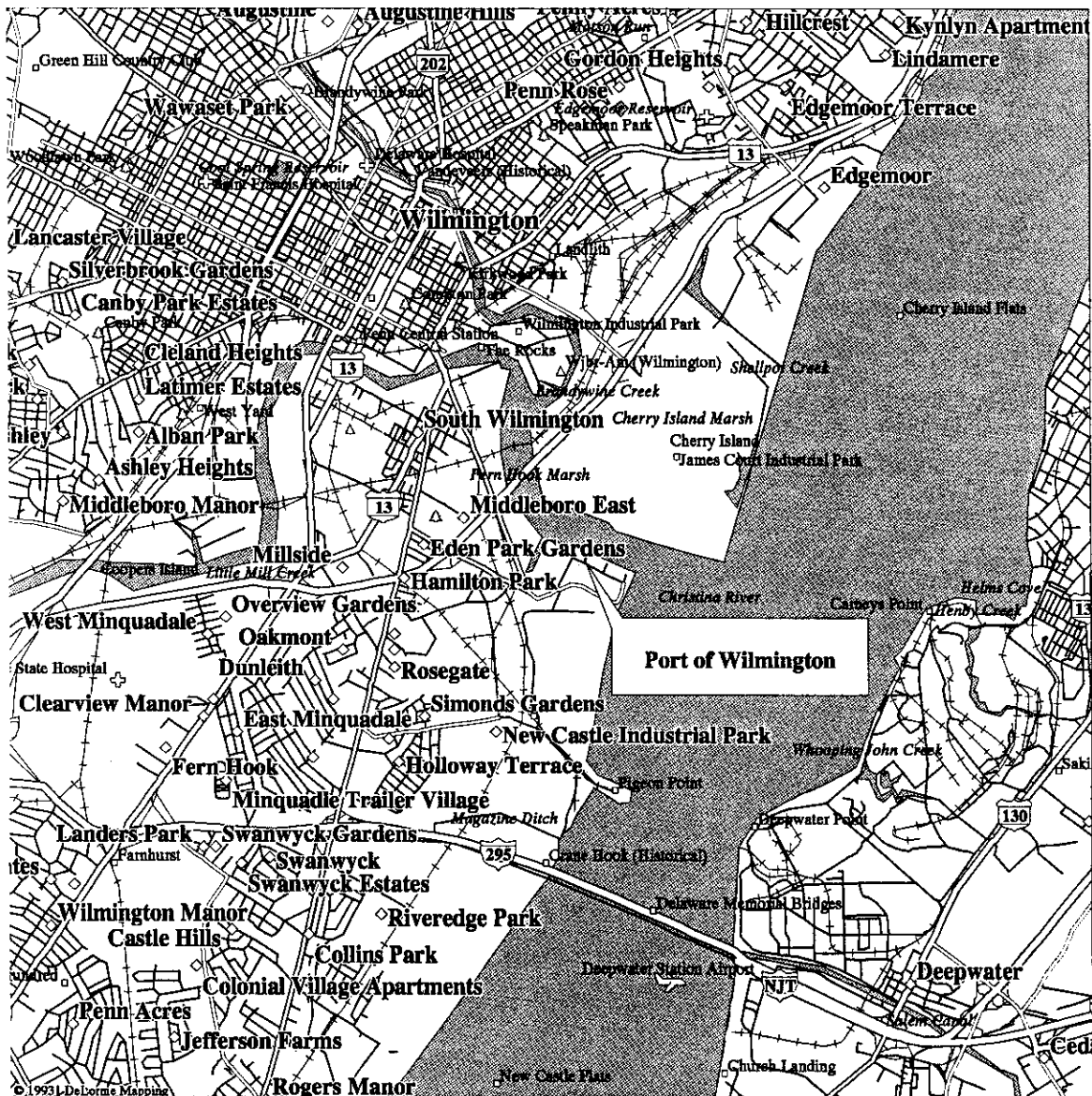
The city of Seattle is situated on a low ridge lying between Puget Sound on the west and the Green River valley on the east. The Olympic Mountains, which rise steeply from the Puget Sound are located approximately 80 km (50 mi) to the northwest. The mild climate of the Pacific Coast is modified by the Cascade Mountains and to a lesser extent by the Olympic Mountains. The climate is characterized by mild temperatures, a well-defined rainy season and prolonged cloud cover, especially during the winter months. The Cascades act as a very effective barrier in both winter and summer, shielding the region from both extreme cold and heat, respectively. The rainy season extends from October through March, with December accounting for the most rainfall. Approximately 75 percent of the annual total precipitation occurs during the winter rainy season. The dry season is centered around July and August. The majority of Seattle's precipitation is associated with normal, mid-latitude disturbances, which are most vigorous during the winter months. During summer, the dominant storm track (e.g., the polar jet) shifts northward into southern Canada, reducing the precipitation in the area. Summer thunderstorms do occur but do not contribute measurably to the annual rainfall budget. Prevailing winds are from the southwest, but occasional severe winter storms will produce strong northerly winds. Summer winds are generally rather light, with the occasional evidence of land-sea breeze effects creating northerly flows. Fog and low-level stratocumulus clouds form over the southern Puget Sound area in the late summer, fall, and early winter months, and often dominate the weather conditions of the early morning hours, reducing surface visibilities. Based on the 1951-1980 climatology, the first occurrence of freezing temperatures should occur around November 11, and the last incidence in spring around March 24 (NOAA, 1992g).

D.2.2.22 Wilmington, DE

The city of Wilmington, DE, sited on the Christina River, has large manufacturing interests. Both sides of the river at the city are lined with wharves that primarily support barge traffic. Deepwater facilities are located at the Port of Wilmington on the south side of the Christina River. The port is located about 3 km (2 mi) north of the Delaware Memorial Bridge on the left ascending bank of the Delaware River, approximately 100 km (62 mi) above the entrance to the Delaware Capes. The port is south of the city of Wilmington and is situated in an area of heavy industrial usage, which appears to be remote from residential, light business, and manufacturing areas (DOC, 1993c). A map of the city is shown in Figure D-53.

Access to the Port of Wilmington is gained via the Delaware Bay and Delaware River. The bay has natural depths of 15.4 m (50 ft) or more for a distance of 8 km (5 mi) from the entrance. A Federal project provides depths of 12.2 m (40 ft) past the entrance to the Christina River where the project depth is 10.6 m (35 ft). A traffic separation scheme has been established off the entrance of the Delaware Bay because of restrictions on passage through the bay and on up the Delaware River. Ships travelling to Wilmington must pass under the Delaware Memorial Bridge (DOC, 1993c).

The port is owned by the City of Wilmington. It is an "operating" port with stevedoring handled by two outside stevedoring companies. Principal cargoes are imported automobiles, dry bulk, roll-on/roll-off and refrigerated containers (primarily bananas and other tropical fruit) (POW, 1994). In 1993, the port handled about 936,000 metric tons (1,026,397 tons) of containerized cargo (about 100,000 20-ft equivalent units; AAPA, 1994). The port has 10,218 m² (110,000 ft²) of chill/heat space and 36,806 m³ (1,300,000 ft³) of chill/freezer warehouse space. The terminal has two multi-purpose container cranes and one bulk cargo gantry crane. The marginal wharf area is 1,158 m (3,800 ft) long and there is a 155 m (510 ft) long floating roll-on/roll-off berth. Depth alongside the terminal at mean low water ranges from 11.58 m (38 ft) to 10.67 m (35 ft) due to silting. The port is equipped with one 40.6 metric ton (45 ton) multi-purpose container crane, one 29.1 metric ton (32 ton) multi-purpose container crane, and one 11 m³ (14 yd³) Clyde gantry crane (AAPA, 1993; Jane's, 1992; POW, 1994). Approximately half of the cargo going in and out



LEGEND

Population Center	Major Street/Road
Geo Feature	State Route
Town, Small City	Interstate Highway
Hill	US Highway
Park	Railroad
US Highway	River
County Boundary	Open Water
Hwy Ramps	
Street, Road	
Street, Road	

Scale 1:50,000 (at center)

5000 Feet

1000 Meters

Mag 13.00

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"Map(s) from MapExpert, DeLorme Mapping, Freeport, ME."

Figure D-53 Map of the Port of Wilmington, DE

of the port is food. Improved tropical fruit comprised 35 percent of the traffic in the port, while manufactured food products and finished perishables make up another 15 percent of the cargo traffic. Forest products handle 15 percent of the cargo traffic and imported steel makes up 7 percent. Several bulk commodities that are nonhazardous are the remaining 28 percent of the cargo handled by the port (Brooks, 1994).

The Port of Wilmington has direct access to I-495, a connector to I-95, which appears to be less than 1.6 km (1 mi) from the port and runs through the industrial district surrounding the Terminal. The Conrail and CSX railroads serve the port; it is not known if direct ship/rail transfer is possible.

Other Pertinent Information: Security of the general cargo terminals is maintained by the port police on a 24-hour basis. The wharves are fenced and truck access is via controlled terminal entrances. There is presently no place within the port for segregation and temporary storage of hazardous cargoes. There are no general cargo container lines currently serving the port, and there is no commercial container facility.

According to the Sandia National Laboratories' Radioactive Materials Postnotification Database, the port has not handled spent nuclear fuel since October 1984, when the database was initiated (SNL, 1994). There are no known conflicts with other hazardous materials in the immediate container terminal area. There are, however, chemical plants near the port, as well as a diversity of marine terminals and heavy tanker traffic (ship and barge) on the Delaware River. Other than increased risk of collision, these conflicts are not considered a major factor.

The port relies on the City of Wilmington's fire department for response in the event of a terminal hazardous materials accident. The port claims there is no hazardous materials training program and avoids handling hazardous materials (Casper, 1993).

There are no known protected habitats or sanctuaries near the port. However, at the mouth of the Christina River near the location of the port, there are extensive wetlands along the banks of the Delaware River.

The likelihood of severe natural phenomena, such as high winds and earthquakes, is reflected in the structural requirements for buildings in each area of the United States. These are shown in the Uniform Building Code (UBC, 1991). For the Port of Wilmington, the Uniform Building Code requires buildings to withstand wind speeds up to 130 km/hr (80 mph). The port is located in a low seismic zone with an acceleration of 0.075 g.

The 1990 population within 16 km (10 mi) of the port terminals was 381,502. The affected populations within 0.8 km (0.5 mi) of the interstate routes to the five potential DOE management sites are: Savannah River Site, 359,000; Oak Ridge Reservation, 297,000; Idaho National Engineering Laboratory, 535,000; Hanford Site, 584,000; and Nevada Test Site, 718,000. Populations along rail routes to these sites are slightly larger. These populations are shown in Tables D-7 through D-16 in Section D.1. The distances to the five potential sites on interstate routes are: Savannah River Site, 1,120 km (697 mi); Oak Ridge Reservation, 1,040 km (645 mi); Idaho National Engineering Laboratory, 3,890 km (2,416 mi); Hanford Site, 4,560 km (2,832 mi); and Nevada Test Site, 4,160 km (2,588 mi). Distances along rail routes are about the same.

Environmental Conditions

The Port of Wilmington is located within Zone 5 (Delaware Estuary/Bay) of the Delaware River. Protected water uses for Zone 5, which encompasses River Mi (RM) 48-79, are water supply (industry), wildlife, resident fish propagation and maintenance, anadromous fish passage, primary contact, and navigation (DRBC, 1994). However, within Zone 5, fish and other aquatic life are currently impacted due

to low dissolved oxygen levels from point and nonpoint source discharges. Further south in Delaware Bay (Zone 6), shellfish consumption is an impaired use due to bacterial infestations from local point and nonpoint sources.

The Delaware River at Wilmington is classified as a low salinity estuarine (generally 0.5 to 5 ppt) and tidal freshwater habitat. Aquatic organisms typically found in the waters of this area include: American shad, atlantic sturgeon, American eel, blueback herring, shad, alewife, white catfish, brown bullhead, perch, striped bass, bluegill, crappie, pumpkinseed, largemouth bass, carp, and chain pickerel (FWS, 1980f). In addition, the Delaware River is used as a migratory area by the shortnose sturgeon, a Federally listed endangered species. South of Wilmington, the shoreline of the Delaware River becomes much less developed and numerous fish and wildlife management areas and wetlands are found along the lower Delaware River and Bay. Bald eagles are found throughout these areas. The Delaware Bay supports high densities of geese and ducks along the shores. Waterfowl, particularly loons and grebes, and seabirds, particularly gannet, Wilson's petrel, and greater shearwater are also found in the Bay area. Osprey, peregrine falcon, and Cooper's hawk migrate in fall along the Delaware Bay to Cape May Point. High densities of whitetail deer also occur along the shore of the Bay (FWS, 1980f).

The Delaware Natural Heritage Inventory reported that "there are no Species of Special Concern within 0.8 km (0.5 mi) of the Port of Wilmington" (Dalton, 1994). However, the Inventory reported that the Peregrine falcon (Federally listed endangered) has nested 2.4 km (1.5 mi) from the port, and the short-nosed sturgeon (Federally listed endangered) is found in the Delaware River. It was the opinion of the Inventory that "these species would not be affected by normal operations at the port."

Climatic Conditions

Geographically, Delaware is part of the Atlantic Coastal Plain, which consists mainly of flat lowland and marshes. Small streams and tidal estuaries comprise the major drainage systems for the State. The Delaware River, Delaware Bay, and Atlantic Ocean form the eastern border of the State, while the Chesapeake Bay is the western boundary [approximately 56 km (35 mi) to the west]. These large water bodies contribute significantly to the climate of the Wilmington, DE, region.

Generally, summers are warm and humid and winters are considered rather mild. Summer temperatures rarely exceed 100°F, and average daily temperature during January (the coldest month) is 32°F. The majority of winter precipitation falls as rain, but precipitation during the winter months is often mixed rain, snow, and sleet. However, frozen precipitation rarely remains on the ground more than a few days. The proximity of the water masses causes humidity to remain relatively high year-round, which causes frequent fog events. Light southeasterly winds (e.g., off the Delaware Bay) tend to be most favorable for fog formation, while north-northeast winds tend to transport industrial pollution from the Philadelphia metropolitan area into the region. Rainfall distribution is fairly uniform throughout the year, but the greatest amounts normally come during the summer months in the form of thunderstorms. During the fall, winter, and spring seasons, the majority of rainfall is associated with extratropical and tropical cyclones track along the eastern seaboard of the United States. Hurricane-force winds are rarely experienced in the Wilmington, DE, region. However, strong south and southeasterly winds can cause high tides in Delaware Bay and the Delaware River, causing lowland flooding and damage to bayfront and riverfront properties (NOAA, 1992k).